Sanitary Institute of Great Britain.

TRANSACTIONS, VOLUME VII.

ERRATA.

Page 36. Third Plate, Sketch No. 1: for "Intake Reservoir at Soucieu," *read* "Outlet Reservoir at Soucieu."

Page 37. Plate, Sketch No. 2: for "Intake Reservoir at Soucieu," *read* "Outlet Reservoir at Soucieu;" for "Outlet Reservoir at Brignais," *read* "Intake Reservoir at Brignais."

1886–7.

TRANSACTIONS

OF THE

Sanitary Institute of Great Britain.

VOLUME VIII.

CONGRESS AT YORK.

1886-7.

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1887.

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Sanitary Institute of Great Britain.

Formation of the Institute.

The increasing importance attached to Sanitary Science and the recognised position it was assuming in the public mind, appeared to the promoters of the Sanitary Institute fully to justify the formation of a National Society, the object of which should be to devote itself *exclusively* to the advancement of all subjects bearing upon Public Health. In furtherance of the object, a meeting was held at St. James's Hall, on the 13th of July, 1876, at which His Grace the Duke of Northumberland presided, when it was unanimously resolved:—

First—"That in the opinion of this meeting the sanitary condition of this country is still very unsatisfactory, and that further legislation is necessary with a view to its improvement; and that for the purpose of collecting and imparting information upon all matters connected with the subject of 'Public Health' a Society be now formed, to be styled 'The Sanitary Institute of Great Britain.'"

Second—"That the gentlemen whose names are appended be requested to act as a Committee (with power to add to their number) for the purpose of carrying out the previous resolution and of reporting to an adjourned public meeting to be held during the second week in October next."*

The Committee appointed to report upon the subject considered it would add greatly to the usefulness of the Institute if Mayors of Boroughs, Chairmen of Local Boards, Sanitary Authorities, Medical Officers of Health, and all who have to administer the Public Health Acts, would associate themselves with the Institute, either in their individual or corporate capacity, and take part in its proceedings. By thus bringing their united knowledge and experience to bear upon Sanitary matters, the laws relating to the same would become better known and be more efficiently administered.

Basis of the Constitution of the Institute.

Section I.

Charter of Incorporation, Membership, and Government of the Institute.

As soon as practicable a Charter of Incorporation shall be obtained, as it will facilitate some portions of the work of the Institute, more especially the examinations as set forth in Section II. Until a Charter

* An adjourned public meeting was held on the 14th of March, 1877, when the report was unanimously adopted and a Council subsequently appointed to carry it into effect.

is obtained, the examinations shall be continued as heretofore, and a Register of persons certificated as competent to act as Local Surveyors and Inspectors of Nuisances shall be formed.

The Institute shall consist of Fellows, Members, Associates, and Subscribers.

Fellows shall be elected by ballot by the Council, and shall include scientific men of eminence, persons of distinction as Legislators or Administrators, and others, who have done noteworthy Sanitary work.

Fellows are only elected from among the Members, and they must have been Members for at least one year before they are eligible for election as Fellows.

All Fellows shall pay a fee of Ten Guineas on taking up the Fellowship, and such fee shall entitle the Fellow to all the privileges and advantages of the Institute for life without further payment.

Any person proposed by three Fellows or Members, shall be eligible for election as a Member of the Institute.

Members shall be elected by ballot by the Council, and shall be eligible to serve on the Council, and to vote at all Elections and Meetings of the Institute. The admission Fee payable by a Member shall be Three Guineas, and the Annual Subscription Two Guineas.

Medical Officers of Health and Medical Men holding Certificates in Sanitary Science from any University or Medical Corporation shall be entitled to be enrolled as Members of the Institute without Admission Fee.

Members desirous of becoming Life Members may do so on payment of Ten Guineas in lieu of the Annual Subscription.

All persons who have passed the Examination and received the Certificate for Local Surveyor from the Institute, shall, by virtue of having so passed, become Members of the Institute upon the payment of Five Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Any one proposed by two persons, either Fellows, Members, or Associates of the Institute, shall be eligible to be elected as an Associate of the Institute, the election to be by ballot by the Council. The Admission Fee payable by Associates shall be Two Guineas, and the Annual Subscription One Guinea.

All persons who have passed the Examination and received the Certificate for Inspector of Nuisances from the Institute, shall, by virtue of having so passed, become Associates of the Institute upon the payment of Three Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Persons of either sex, interested in the advancement of Sanitary Science, shall be entitled to be enrolled as subscribers on payment of One Guinea annually.

Donors of Ten Guineas and upwards shall be entitled to be enrolled as "Life Subscribers," with all the privileges and advantages of Annual Subscribers without further payment.

Fellows, Members, Associates, and Subscribers shall be entitled to attend and to take part in the discussions at all meetings and Congresses of the Institute, and shall have free admission to any

Conversazione given by the Institute and Exhibitions of Sanitary Appliances held in connection with the Institute as long as they continue to pay their Subscription.

Holders of Half-Guinea Congress Tickets are entitled to the use of the Reception Room in the town of meeting, to admission to the Presidential and other Addresses, to all the Meetings, to the Exhibition of the Institute, and to any Conversazione given by the Institute.

The Institute shall be governed by a President, Vice-Presidents, and a Council of Twenty-four, consisting of Fellows and Members of the Institute, of whom not less than two-thirds shall be Fellows. The Council shall be chosen by the Fellows and Members. One-fourth of the Council shall retire annually, and shall not be eligible for re-election for one year.

The first President of the Institute shall be His Grace the Duke of Northumberland. Future Presidents and Vice-Presidents shall be elected by the Council. The Council shall have the power of electing Honorary Members of the Institute, Honorary Foreign Associates, and Corresponding Members of the Council.

Section II.

Objects of the Institute.

To devote itself to the advancement of Sanitary Science and the diffusion of knowledge relating thereto.

To examine and to grant Certificates of Competence to Local Surveyors and Inspectors of Nuisances, and to persons desirous of becoming such or of obtaining the Certificate. The Examinations shall be held at such times and in such places as the Council may direct.

A Board of Examiners shall be appointed by the Council; such Board shall consist of gentlemen representing Medical, Chemical, and Sanitary Science, Engineering, Architecture, and Sanitary Jurisprudence.

The Examination for Local Surveyors shall include a competent knowledge of the Statute relating to Sanitary Authorities, of Sanitary Science and Construction, and of Engineering.

The Examination for Inspectors of Nuisances shall comprise the elements of Sanitary Science, together with Sanitary Construction, and the Statutes relating to the prevention of disease and the suppression of nuisances injurious to health.

Fees shall be charged for the Examinations, and a Certificate of Competence, signed by the Examiners, shall be granted to successful candidates, entitling them to be designated as "Certificated by the Sanitary Institute of Great Britain."

A Congress shall be held by the Institute for the consideration of subjects relating to Hygiene at such times and places as the Council may direct.

Exhibitions of Sanitary Apparatus and Appliances shall be held from time to time as the Council may direct.

Fellows, Members, Associates, and Subscribers shall have the right of Free Admission to the Exhibitions of the Institute whenever they are open. All fees payable by Exhibitors and the Public shall be fixed by the Council and belong to the Institute.

A Catalogue shall be published under the direction of the Council as a permanent record of the Exhibitions.

The Institute shall take such steps as may be within its power to obtain a complete registration of sickness, especially of preventible diseases.

The Institute shall endeavour to secure the services of medical men and others specially qualified to give lectures on subjects relating to the prevention and spread of disease.

The Institute shall encourage the formation of classes for technical instruction in Sanitary Science in such a way as may seem advisable to the Council.

A Library shall be formed in connection with the Institute.

ANNUAL REPORT OF THE COUNCIL

FOR 1885-6.

In presenting the Annual Report to the Fellows and Members of the Institute, the Council can look back upon nine years of continuous work and steady progress in the growth of the Institute, and in attaining the objects for which it was established.

The Financial Statement shows an improvement even upon the favourable one presented last year. This is due in a large measure to the proceeds from Dr. Farr's works and from the Exhibition, and to the fact that although the Institute is steadily increasing, very little increase has been made in the working expenses. The large item for the printing of Transactions includes the cost of two volumes. It should be mentioned that although there was a large balance in the Bank at the end of the year, various accounts for the printing and binding of Dr. Farr's Works, which had to be met early in the year, prevented the Council investing any part of this amount.

The Anniversary Meeting of the Institute was, by kind permission of the Board of Managers, held in the theatre of the Royal Institution on July 9th, 1885. The chair was taken by Sir John Lubbock, Bart., M.P., D.C.L., F.R.S., Vice-President of the Institute; and the Medals and Certificates awarded at the Exhibition at Dublin in September, 1884, were presented by him to the successful exhibitors. Prof. W. H. Corfield, M.A., M.D. (Oxon), read a paper on "The Water Supply of Ancient Roman Cities, with especial reference to Lugdunum (Lyons)," which will be published in Vol. VII. of the Transactions of the Institute.

The Annual Congress was held in Leicester, under the Presidentship of Prof. F. S. B. F. de Chaumont, M.D., F.R.S. and the meeting proved a great success.

The Local arrangements for the meeting were very well carried out, and the attendance at the Inaugural Address and some of the other meetings was larger than usual.

The Council proposed as special subjects for discussion at the meetings:—In Section I.: Infantile Diarrhœa and Small-pox repression. In Section II.: Sewerage and Sewage Treatment, and Hospital Construction; and in Section III.: The Geology of the neighbourhood of Leicester. These, and many other interesting subjects were brought forward.

The building allotted to the Exhibition was very suitable for the purpose, but a large Annexe had to be added to accommodate all the Exhibitors who applied for space.

The Exhibits shewed a decided improvement in the manufacture of Sanitary Apparatus and Appliances. Cookery lectures were given every day in the Exhibition, and also demonstrations of butter making, &c., a model dairy having been fitted up for the purpose. The Electric Light was used throughout the building, and the Exhibition proved altogether very attractive; 37,000 persons passed the turnstiles during the 17 days the Exhibition was open. There were 135 Exhibitors and about 1000 Exhibits. The Judges awarded Silver Medals, presented by the Leicester Gas Company, and by the Exeter Gas Company, 14 Bronze Medals of the Institute, 11 Special Certificates, and 62 Certificates—the Special Certificates being awarded to articles which had received Medals at previous Exhibitions of the Institute. 119 Exhibits were deferred for further practical trial and testing; the result of these trials will be reported at the Anniversary Meeting in July, when all the Medals and Certificates will be presented.

The number of Candidates for the Examinations still continues to shew a very rapid increase. At the Examination in June twenty-five Candidates presented themselves: nine for Certificates as Local Surveyors, and sixteen for Certificates as Inspectors of Nuisances. Three Candidates were certified to be competent, as regards their sanitary knowledge, to discharge the duties of Local Surveyors, and fourteen to discharge those of Inspectors of Nuisances. At the Examination in November, thirty-nine Candidates presented themselves: eleven for Local Surveyors, and twenty-eight for Inspectors of Nuisances. Two Candidates were certified to be competent to discharge the duties of Local Surveyors, and nineteen to discharge those of Inspectors of Nuisances. All unsuccessful Candidates have the option of coming up for examination a second time for one fee.

The Council are very pleased to note that the Parkes Museum has instituted, for the instruction of Sanitary Inspectors, a very valuable and well arranged course of Lectures which have been thoroughly appreciated by the Candidates coming up for the examination of the Institute, there being no other classes at which instruction is given in the duties of Inspectors of Nuisances.

The Council mentioned in the last Report that they were considering the feasibility of co-operating with the Association of Public Sanitary Inspectors, with a view to practically enlisting the interests of that Association in the work of the Examinations; but after carefully discussing the suggestions made by that Association, the Council reluctantly came to the conclusion that they could not be entertained; the negotiations have therefore terminated.

The Council have to report with much regret the death of the Right Hon. the Earl of Shaftesbury, K.G., Vice-President of the Institute, General Bartlett and Daniel Clark, Fellows; Josiah Atwool, G. Chorley, and J. Lee, Members; Joshua Dixon, Subscriber.

Since the last Annual Meeting there have been elected 17 Members and 14 Associates. The numbers on the roll of the Institute were, at the end of 1885, 95 Fellows, 209 Members, 54 Associates, 13 Subscribers, and 29 Honorary Foreign Associates: total, 400.

The retiring members of Council are: Dr. H. C. Bartlett, F.C.S.; Mr. W. R. E. Coles; Prof. T. Hayter Lewis, F.R.I.B.A.; Mr. J. E. Lingard, A.M.INST.C.E.; Magnus Ohren, A.M.INST.C.E; and Mr. H. C. Stephens, F.L.S., F.C.S.

The following gentlemen are nominated for election at the Annual Meeting to fill the vacancies thus created: T. W. Cutler, F.R.I.B.A.; Director-General Sir Thomas Crawford, K.C.B., M.D.; Major Lamorock Flower; Baldwin Latham, M.INST.C.E.; E. C. Robins, F.S.A.; F.R.I.B.A.; and M. Ogle Tarbotton, M.INST.C.E.

The publication of an Abstract of the writings of the late Dr. William Farr, Vice-President of the Institute, was successfully completed in December last, and the value of the publication seems to have fully satisfied the expectation of all those who subscribed to the work. The Council consider that the book is a valuable addition to Sanitary literature; it should also be noted that the undertaking has proved financially successful. Six hundred and twenty copies were subscribed for besides those sold to the public; this more than

meets the expenses of the publication, besides leaving the remainder of the first edition of one thousand copies in the hands of the Institute.

The success which has attended the publication of the writings of the late Dr. Farr, and the many testimonials that the Council have received as to its usefulness as a work of reference, have induced them to entertain a proposal to undertake the publication, in a similar way, of the works of Mr. John Simon, C.B., F.R.S. Mr. Simon has offered to give the Council every facility, and to assist them in the publication; and Dr. Edward Seaton has offered to undertake the editing of the work. Before finally deciding, however, upon the publication, the Council are sending out a preliminary circular to ascertain what amount of support they may expect to receive.

Seven general Lectures upon Sanitary subjects have been given in the Parkes Museum during the past year, and the Members of the Sanitary Institute have had the privilege of attending these as well as of using the Library of the Museum, which contains a very large collection of books on Sanitary and allied subjects.

The Council have during the year had under discussion the very important subject of amalgamating the Institute with the Parkes Museum, with which it is already so closely allied. The Council are convinced that such an amalgamation would tend greatly to advance the objects which both the Institutions have at heart, but as the subject has already been brought before the members at a recent meeting, and been approved by them, it is unnecessary to say anything further. The Council have reason to believe that the Members of the Parkes Museum are of the same opinion, but this has not yet been confirmed at a formal meeting.

The Institute has accepted an invitation to hold its Congress and Exhibition this year in York. It is well known that great success has usually attended meetings of other learned Societies in that City, and the Council trust that the coming Congress will prove no exception.

SANITARY INSTITUTE OF GREAT BRITAIN.

Abstract of Cash Receipts and Payments for the Year ending December 31st, 1885.

	£ s. d.	£ s. d.
To Balance at Bank, January 1st, 1885 ...		122 0 7
,, Fellowship Fees	21 0 0	
,, Admission Fees	35 14 0	
,, Life Composition	70 7 0	
		127 1 0
,, Annual Subscriptions		204 15 0
,, Transactions and other Publications ...	33 6 10	
,, Congress	44 2 0	
,, Examinations	173 5 0	
		250 13 10
,, Dr. Farr's Works		266 0 6
,, Transfer from Exhibition Account ...		700 0 0
		£1670 10 11

	£ s. d.	£ s. d.
By Office Furniture	10 14 6	
,, Rent and Taxes	52 10 0	
,, Salaries and Wages	255 18 10	
,, Postage, Telegrams, and Carriage ...	34 14 9	
,, Incidental Expenses	24 11 3	
,, Stationery and Printing	37 19 3	
,, Medals and Certificates	17 13 6	
,, Library	0 4 6	
,, Advertising	0 16 4	
		435 2 11
,, Transactions	261 17 0	
,, Congress	116 1 3	
,, Examinations	138 5 4	
		516 3 7
,, Dr. Farr's Works		147 8 8
,, Balance at Bank, December 31st, 1885...		571 15 9
		£1670 10 11

EXHIBITION ACCOUNT.

	£ s. d.
To Balance January 1st, 1885	272 18 2
,, Receipts	909 3 6
	£1182 1 8

	£ s. d.
By Expenditure	469 3 9
,, Transfer to General Account	700 0 0
,, Balance	12 17 11
	£1182 1 8

Audited and confirmed,

MAGNUS OHREN,
EDWARD C. ROBINS, } *Auditors.*

24th May, 1886.

ADDRESS

By Captain Douglas Galton, C.B., D.C.L., F.R.S.,

CHAIRMAN OF COUNCIL.

Read at the Annual Meeting, May 27th, 1886.

Gentlemen,—In moving the adoption of the Report, I should like to say a few words upon the present position of the Institute, in relation to sanitary progress in the country; for I hope that we are about to take an important step in further developing the objects for which the Institution was founded; and the present moment is therefore a convenient one for briefly taking stock of the progress we have so far made.

The Sanitary Institute may be said to have come into existence when there was a general awakening of the public to the necessity for improved sanitary procedure.

I look upon it that its main object was to endeavour to elevate the standard of sanitary knowledge among the public, and to create as it were an aristocracy of sanitarians.

The methods by which the Sanitary Institute seeks to secure this object, so far as its internal organization is concerned, is by making the position of Fellow obtainable only by selection from among the members at the instance of the Council; and it seeks to raise the standard of sanitary knowledge amongst the outside public by holding Congresses and Exhibitions, and by instituting Examinations for those classes of officials specially engaged in the sanitary service of the country, viz.: the Local Surveyor and the Inspector of Nuisances, by means of which to test their competency in sanitary knowledge for these appointments.

These being its objects, I think the Sanitary Institute may fairly be congratulated on having made a definite and continual progress ever since its formation, more than ten years ago; and to all who have watched its progress, it is evident that its success has been due to the fact that it has honestly and consistently kept in view the functions for which it was originally formed, viz.: to promote the advancement of Sanitary Science, and the diffusion of knowledge relating thereto.

1. Our Congresses have, year by year, increased in influence and in repute.

2. The towns who are desirous of receiving us are now numerous.

3. The volumes in which the transactions of our Congresses are recorded contain a large amount of valuable information; our publications have not been limited to these volumes; upon the suggestion of some of our most eminent members, we undertook the publication, in a condensed form, of the life work of Dr. Farr, who I think I am justified in calling the ablest sanitary statistician of this or any country. I need hardly say that that work, which has been edited by my friend Mr. Humphrey, not only does great credit to the Editor, and forms a lasting monument of Dr. Farr's eminent scientific knowledge, but it reflects its lustre upon the Sanitary Institute. I trust that we shall similarly soon arrange to publish a digest of the now scattered works of that eminent sanitarian, Mr. John Simon.

4. The Exhibitions of Sanitary Appliances, which are an integral part of our Congresses, are attaining a position of special importance. Manufacturers are anxious to obtain our certificates; and I may safely assert that these Exhibitions are so conducted as to fulfil their mission of continually improving the knowledge of the public in the principles which should govern the form and construction of sanitary appliances.

Those of the Members of the Sanitary Institute who have not been Members of the Council, can have little idea of the amount of earnest zeal and of self-sacrificing spirit which has animated those Members of Council who have performed the function of Judges of these Exhibitions, and which has led to the satisfactory results which have been attained.

The work is voluntary work; the Judges have devoted a large share of their valuable time, taken from professional occupation, to decide upon the merits of the Exhibits.

I would here desire to point out that the experience gained by the Exhibitions shows that a very important adjunct to real progress in the design of sanitary appliances would be an arrangement by which the more notable of the Exhibits of one year should be kept together, so as to be capable of being studied by all persons interested, instead of being dispersed as soon as the Exhibition is closed.

I need scarcely mention that the object of the Parkes Museum is to afford a place where valuable and new methods of the application of sanitary science to practical use may be studied by the public.

You thus see that for this reason the Parkes Museum, in this part of its work, forms a necessary adjunct to our system of

Annual Exhibitions of Sanitary Appliances. It provides the link which shows the connection between the best appliances of one year with the improvements of the next.

But I wish to point out to you that it is chiefly to the method which we have inaugurated for judging the Exhibits in each consecutive Exhibition, that we owe the high estimation in which our certificates are now held.

The great difficulty in the judging of the merits of Exhibits in consecutive Exhibitions, that is to say, of obtaining a standard of value between the articles exhibited in one Exhibition and those exhibited in another Exhibition, and between articles exhibited, and what may be called the normal condition of invention in the case of any particular article, has in other Exhibitions been due to the fact that the appointment of the Judges or Juries has been an after thought. They have generally been selected after the Exhibition has been arranged and the articles received, and they have had no voice in deciding upon the conditions under which the Exhibits have been received.

Moreover, different principles have governed the Judges, or the Juries specially selected for the occasion, in making their awards.

This difficulty we believe that we have overcome.

In our Exhibitions, the one important consideration which we have kept in mind, has been to ensure consistency in the awards of consecutive years.

The judging of the Exhibits in our Exhibitions takes place upon a continuous systematic plan. This is secured by having a permanent Committee of Judges, whose professional avocations ensure their being always in the most favoured position for acquiring a knowledge of what is the state of invention as regards the several appliances, and of how the new appliances work in practice.

This Committee, moreover, in the first place lays down the conditions upon which the Exhibits are to be received.

But whilst this permanent Committee provides for a certain uniformity in the principles upon which the awards are made, it allows at the same time sufficient elasticity to prevent the judging degenerating into mere formalism.

5. In the next place, a notable work of the Institute lies in the Examinations.

I think it may be truly said that the value of the Examinations has become, every year, more and more appreciated by the public, and their importance more and more recognised.

That this is so, has been due partly to the growing feeling amongst public bodies of the necessity of requiring a knowledge

of sanitary matters in the officers they appoint under them to supervise sanitation, and also in the care which we have taken to give the Examinations that practical character which the subject requires.

In order to effect this, the Examiners devote much care to the selection of questions, and to the conduct of the *viva voce* Examinations.

It seems certain that the Examinations provide for a real want. This is evidenced by the fact that the numbers who present themselves have increased steadily year by year, and for the approaching Examination on the 3rd and 4th June, the numbers who have entered amount to sixty-three.

The experience which the Examiners have obtained from the Examinations, and which I may say has been apparent to me in the position I have also held as Examiner in Public Health for the Universities of Oxford and London, proves that besides the opportunity for Examinations, one of the most important needs of the present time is the opportunity for studying the subjects in which we examine.

It is a very remarkable fact that although the University of London, and the Universities of Oxford and Cambridge have all instituted examinations which embrace these matters, they have not yet developed any school for teaching; and there is nowhere at the present time any systematic instruction given in practical Hygiene which is available to the general public.

I do not forget that Dr. Corfield is Professor of Hygiene at University College, and there is a Professor at King's College, and that Dr. de Chaumont is Professor of Hygiene in the Army Medical School at Netley; but there is no available public means of instruction in matters relating to Health for the large body of Surveyors, Sanitary Inspectors, and others whose actual duties are connected with Public Health.

I cannot too strongly emphasize this matter, because in the case of each Examination, the want of such a course of instruction is prominently brought to the notice of those of your members who form the Board of Examiners.

At the last Examination which we held, the number of candidates was so large, and the replies of the candidates evinced so marked an evidence of the want of opportunity among the candidates of obtaining tuition in the subjects in which we examined them, that the Board of Examiners set themselves seriously to consider how the matter could be remedied.

I have the pleasure to inform you that for the benefit of the candidates who are expected to present themselves at the Examinations which we are about to hold early in June, and

for which, as I said, sixty-three candidates have been entered, the Council of the Parkes Museum instituted a course of Lectures during this spring.

These Lectures were specially arranged by the Parkes Museum for the instruction of those desirous of obtaining knowledge required for the due performance of the duties of Sanitary Inspectors, and to suit the requirements of persons preparing for the Examinations of the Sanitary Institute of Great Britain; and they therefore comprised the subjects scheduled for the Examinations of the Sanitary Institute.

The various subjects were dealt with in a course of twelve lectures, given by well-known authorities.

1. Introductory Lecture—General History, Principles, and Methods of Hygiene.—Dr. GEORGE WILSON, M.A., F.R.S.E.
2. Ventilation, Measurement of Cubic Space, &c.—Prof. F. DE CHAUMONT, M.D., F.R.S.
3. Water Supply, Drinking Water, Pollution of Water.—Prof. W. H. CORFIELD, M.A., M.D.
4. Drainage, Construction.—Prof. H. ROBINSON, M.INST.C.E.
5. Sanitary Appliances.—Mr. W. EASSIE, C.E., F.L.S., F.G.S.
6. Scavenging and Disposal of Refuse.—Mr. H. PERCY BOULNOIS, M.INST.C.E.
7. Food, good and bad; Milk; Sale of Food and Drugs Act.—Mr. C. E. CASSAL, F.C.S., F.I.C.
8. Infectious Diseases and Methods of Disinfection.—Mr. SHIRLEY F. MURPHY, M.R.C.S.
9. General Powers and Duties of Inspectors of Nuisances.—Method of Inspection.—Mr. J. F. J. SYKES, B.SC., M.R.C.S.
10. Nature of Nuisances, including Nuisances the Abatement of which is difficult.—Mr. J. F. J. SYKES, B.SC., M.R.C S.
11. Sanitary Law—General Enactments, Public Health Act, 1875; Model Bye-Laws.—Mr. A. WYNTER BLYTH, M.R.C.S., L.S.A.
12. Metropolitan Acts, Bye-Laws of Metropolitan Board of Works.—Mr. A. WYNTER BLYTH, M.R.C.S., L.S.A.

A nominal fee only, of Five Shillings for the course, was charged to cover expenses; and the Students attending the course were granted free admission to the Museum and Library of the Parkes Museum, from April 1st to June 1st.

The names of the lecturers are a sufficient guarantee to you

that the lectures were good; and it gives evidence of a public want, that sixty-five persons entered for this new and untried course of lectures, although we were enabled to give but very short notice of the holding of these lectures.

This brings up the question of the value of an examining body as apart from a teaching body.

London University is essentially an examining body, and has no teaching functions; but I am convinced that an examining body which is unconnected with any teaching institution loses much of its value; and such a body is of course quite useless as an institution for training the mind, and forming the character. But I would bring to your notice this consideration, that it is in sanitary knowledge that this question of tuition assumes paramount importance; for the teaching of the majority of subjects in which London University holds examinations, such as Latin, Greek, Mathematics, Languages, Chemistry, Physics, Geology, Music, and equally for the teaching of the majority of subjects proposed for examination in Oxford and Cambridge, there are numerous institutions affiliated or otherwise to these Universities, where students can acquire a knowledge of the subjects in which they are to be examined. But that is far from being the case in sanitary matters.

As I have already mentioned, there are no courses of practical Hygiene generally available to the student; and I know of no institution where the subject is taught practically, so as to be available for the class of persons whom we desire to benefit.

If the Sanitary Institute is to fulfil its functions of diffusing knowledge in relation to sanitary science, it must not be content with holding periodical examinations; it must develop its educational character still further, and it must afford opportunities for students to qualify themselves for these examinations by providing lectures on practical sanitation, and by furnishing laboratories for research in sanitary matters.

The experience which these first ten years of our existence has afforded us, all points to this, that without this complement of the functions which we undertook at our foundation to promote, we cannot usefully fulfil that main object of our existence, viz., the diffusion of sanitary science.

No one can read the regulations under which the Sanitary Institute was founded without seeing that its authors, in founding the Institute, held education to be its primary object.

Its Congresses, its Exhibitions, its Examinations, are all directed to that end. And there is no doubt that if we are to fulfil the objects which its original promoters had in view, we must develop a system of teaching as part of the permanent work of the Institute.

The scheme is incomplete without it.

I wish specially to point out to you that just as the Parkes Museum, in its work as a Museum, affords a complement to the Exhibition work done by the Sanitary Institute, so in the functions which the Parkes Museum is bound to perform under its Articles of Association, of spreading sanitary science by lectures, its work is complementary to that of the functions of Examination of the Sanitary Institute.

If the Parkes Museum did not exist, it would be essential to the proper development of the Sanitary Institute that a Museum of sanitary appliances should be formed under the auspices of the Institute; and that the lectures and cognate means of further instruction in practical Hygiene should be given by the Sanitary Institute.

But fortunately we have the Parkes Museum with its permanent Exhibition of apparatus, and its educational functions ready to our hand.

I therefore feel very strongly that if the Sanitary Institute is to receive the development required to enable it to fulfil its full sphere of usefulness, its association with the Parkes Museum is a necessity.

The amalgamation of the two bodies has already been consented to by a meeting of the Sanitary Institute, and I merely mention these points because I wish to impress upon all members present the fact that this amalgamation is of the highest importance in the interest of the Sanitary Institute; and that we could not properly fulfil the mission which we have undertaken without this further development.

A very little consideration will shew that, unless we are prepared to let the Sanitary Institute collapse, we cannot stand still. We must progress.

The feeling of the country in regard to sanitary matters is daily growing.

Just consider the class of legislation which has been brought forward in late years.

We had first the General Sanitary Acts.

Then Improved Rural Water Supply.

Then we had the Housing of the Poor.

Thus Parliament began twelve or fourteen years ago with legislation on general matters; but each year legislation approaches more and more to the details of sanitation.

For instance last year, in the Housing of the Working Classes Act, a clause was prepared but not passed, which threw upon the owner of every house which was to be let, whether furnished or unfurnished, the duty of putting that house into a sanitary condition, and it proposed to make the

owner responsible pecuniarily for any illness arising from defective sanitation.

That provision was not passed; but this session I observe that a Bill is about to be proposed to require that all Dwelling Houses, and especially all Public Buildings, Schools, Hotels, and establishments for the supply of food, should have their sanitary arrangements certified by some authority of recognised competence.

I do not suppose that that Bill will be passed, but I mention the fact in order to point out to you that the public mind is directed towards the enforcement of detailed provisions in sanitation, and towards increased supervision of the arrangements necessary to ensure health in our crowded communities.

In crowded localities, health depends so largely upon the details. It is often apparently from very trifling causes that the most carefully devised sanitary arrangements are upset. Dr. Carpenter told us last year how much the health of the children in the Board Schools is dependent upon adequate care in using the appliances for ventilation, in adopting properly devised seats and desks, to prevent the undue straining of the muscles of the spine, which may amongst other evils produce shortness of sight; he urges that we should provide physical exercises in all schools to counteract the evils of brain work.

This reminds me of a recent instance of how neglect of small details produces evils.

At the Asylum for Imbeciles, at Darenth, there was recently an outbreak of Typhoid Fever.

The Managers called in skilled assistance to report, and it was found that the cases occurred in certain wards only: in these wards there was a peculiar smell; these wards were warmed by means of hot water pipes laid in a trough in the floor. On examining these troughs it appeared that, in sweeping the floor, dirt from the wards had fallen through the grating covering them, and collected in the trough; in these wards, filled with imbecile children, much of the dirt arose from excreta: moreover, this collection of dirt was of so foul a smell, that the workmen who cleared it out were made sick in the operation.

This is only another instance of the necessity for care in the administration of details, and of the increased vigilance which is necessitated in attention to the details in the case of every improvement which we attempt to introduce into our houses.

I might produce numerous other instances of evils resulting from the want of attention to keep valuable sanitary appliances in a healthy condition; but it would only be wasting your time to do so. What I have already said, will, I trust, have impressed

upon you that in view of the progress which Parliament is making in respect of Sanitary Legislation, and in view of the increased powers of interference and supervision in matters of domestic sanitation which Parliament is giving to Local Boards and Municipalities, it is very incumbent on us to endeavour to improve the education of the public in sanitary knowledge, and specially to ensure the possession of adequate sanitary knowledge to those who are charged by the several Local Boards and Municipalities with the duty of watching over our sanitary arrangements.

I doubt the advisability of making local authorities responsible for inspecting and certifying to the sanitary condition of houses, as suggested in the Bill to be proposed this year, and I believe the more effectual remedy for defective house sanitation would be found in the Bill of last year, which would make the house-owner liable to the person to whom he let a house, or to the persons he received into his house, for any evil arising from insanitary conditions.

But my object in mentioning this subject is to point out that the tendency of legislation is towards a more stringent interference in details, and that if such legislation is not to be mischievous, it must be accompanied by increased knowledge in sanitary matters on the part both of the persons charged with administering the Sanitary Acts, as well as of the public themselves.

This knowledge it is the mission of the Sanitary Institute to endeavour to provide.

I now beg to move that the Report read by the Secretary be approved.

Congresses held by the Institute.

LEAMINGTON, 1877.

President.

B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Edwin Chadwick, C.B.
„ II.—George Wilson, M.A., M.D., F.C.S.
„ III.—R. Brudenell Carter, F.R.C.S.

STAFFORD, 1878.

President.

EDWIN CHADWICK, C.B.

Presidents of Sections.

Section I.—B. W. Richardson, M.D., LL.D., F.R.S.
„ II.—Henry Day, M.D., F.R.C.S.

CROYDON, 1879.

President.

B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Alfred Carpenter, M.D., M.R.C.P.Lond., C.S.S.Camb.
„ II.—Captain Douglas Galton, R.E., C.B., D.C.L., F.R.S.
„ III.—G. J. Symons, F.R.S.

EXETER, 1880.

President.

THE RIGHT HON. EARL FORTESCUE.

Presidents of Sections.

Section I.—Prof. de Chaumont, M.D., F.R.S.
„ II.—R. Rawlinson, C.E., C.B.
„ III.—Sir Antonio Brady.

NEWCASTLE-UPON-TYNE, 1882.

President.

CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

Presidents of Sections.

Section I.—Denis Embleton, M.D., F.R.C.S.
„ II.—H. Law, M.Inst.C.E.
„ III.—Arthur Mitchell, M.A., M.D., LL.D., F.R.S.

GLASGOW, 1883.

President.

PROF. G. M. HUMPHRY, M.D., F.R.S.

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Section I.—Prof. W. T. Gairdner, M.D., LL.D.
„ II.—Prof. T. Roger Smith, F.R.I.B.A.
„ III.—R. Angus Smith, Ph.D., F.C.S.

DUBLIN, 1884.

President.

SIR ROBERT RAWLINSON, C.B.

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„ II.—C. P. Cotton, M.Inst.C.E.
„ III.—Charles A. Cameron, F.R.C.S.I.

LEICESTER, 1885.

President.

PROF. F. DE CHAUMONT, M.D., F.R.S.

Presidents of Sections.

Section I.—Arthur Ransome, M.A., M.D., L.S.A., F.R.S.
„ II.—Percival Gordon Smith, F.R.I.B.A.
„ III.—William Marcet, M.D., F.R.Met.Soc., F.C.S., F.R.S.

YORK, 1886.

President.

SIR SPENCER WELLS Bart.

Presidents of Sections.

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„ II.—Baldwin Latham, M.Inst.C.E., F.R.Met.Soc.
„ III.—William Whitaker, b.a.. f.g.s.

The next Congress and Exhibition of the Institute will be held at Bolton, commencing September 20th, 1887.

CONGRESS AT YORK.

SEPTEMBER, 1886.

PAPERS AND DISCUSSIONS.

CONGRESS AT YORK.

INTRODUCTION.

The Ninth Congress of the Institute was held at York, from Tuesday, September 21st, to Saturday, September 25th, 1886, by the invitation of the Lord Mayor and Corporation.

The Buildings placed at the disposal of the Council were commodious and well adapted for the Meetings of the Congress. The opening Address by the President, Sir Spencer Wells, Bart., and the Lecture to the Congress by Captain Douglas Galton, were delivered in the Saloon of the Fine Art and Industrial Institution, in St. Leonards Place: the Exhibition also was held in the extensive buildings and grounds of that Institution. The Sectional Meetings were held in the Theatre of the Museum of the Philosophical Society.

The Congress opened with a Special Service at the Minster, the Sermon being preached by the Very Rev. The Dean of York. The Members of the Congress were then received by the Lord Mayor and Corporation in the Reception Room at the Fine Art Building, and the Public Luncheon, at which the Lord Mayor presided and welcomed the Institute to the City of York, was held in the De Grey Rooms. After lunch the Lord Mayor and Corporation and Members of the Congress proceeded to the Exhibition, and were conducted round the building by the Judges; the Lord Mayor then pronounced the Exhibition open.

The Exhibition continued open until October 16th. There were 130 Exhibitors, and 900 Exhibits. The Judges awarded 11 Medals, 11 Special Certificates, and 56 Certificates; 42 Exhibits were deferred for further practical trial. About 30,000 people visited the Exhibition during the 23 days it was open.

The papers read to the Congress were divided into three Sections: Section 1, Sanitary Science and Preventive Medicine. Section 2, Engineering and Architecture. Section 3, Chemistry, Meteorology

and Geology. The papers and discussions in Sections 1 and 2 occupied nearly two days each. A Conference of Medical Officers of Health was held on the afternoon of the 1st day of Section 1, at which several subjects that come specially within the province of the Medical Officers were brought forward for discussion. The leading features of the Sectional Meetings and Conference are given in the Reports of the Secretaries, on page 363.

On Wednesday evening a Conversazione was held in the Exhibition and the adjoining rooms and Picture Galleries, which were specially arranged and decorated for the occasion.

A Breakfast was given to the Members of the Congress on Thursday morning, in the De Grey Rooms, by the National Temperance League.

Addresses to the Working Classes were given on Saturday evening in the Festival Concert Room, Museum Street, by Mr. Edward C. Robins, F.R.I.B.A., Dr. George Vivian Poore, and Mr. James Mansergh, M.INST.C.E. The Chair was taken by the Rev. Canon Fleming.

An Excursion was made on Saturday afternoon to the York New Waterworks, at Acomb, by invitation of the Chairman and Directors of the Company.

Many opportunities were given to the Members to visit the numerous places of interest in the City, the Dean, on several occasions, personally conducting the Members over the Minster and Library; the antiquarian rambles were taken through the old city under the guidance of the Rev. Canon Raine.

Mr. Buckle, the Principal of the School for the Blind, kindly arranged a Concert by the Pupils on Saturday morning, to which the Members of the Congress were invited.

It was decided to hold the Congress of 1887 at Bolton, an invitation from the Town Council having been accepted during the Meeting at York.

E. WHITE WALLIS,

Secretary.

15*th April*, 1887.

Officers of the Congress.

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The SHERIFF OF YORK.
His Grace the ARCHBISHOP OF YORK.
The Very Rev. the DEAN OF YORK.
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The Very Rev. the DEAN OF YORK.
The Sheriff of York (S. WRIGHT).
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SERMON

BY THE VERY REV. THE DEAN OF YORK.

PREACHED AT

YORK MINSTER,

September 21*st*, 1886.

PSALM CXIX. 97.

"Lord, what love have I unto Thy law: all the day long is my study in it."—*York Minster*, *September* 21*st*, 1886, 11.30 A.M.

So spake the Psalmist in his unlettered simplicity generations ago, meditating on the Almighty power which (he felt) produced, pervaded, and was sustaining all things, yet alike unfathomable, incomprehensible to him. Little enough could he decipher. One great first cause calling everything into being, and providing alike for the harmonious working of all the (even to him) innumerable agencies and complex mechanism. Unity of Godhead, and unity of order—a grand unison in which there could be no discord, but with which all must be in harmony, subordinate to Him from whom and by whom it came.

Surely, in the words of the text, he is meditating on a law not indicated or comprised only in the Word of God, but in all which, beside that, came from Him: all the works of His hand, all that His divine fiat had ever called into existence; even as the judicious Hooker said, in after years, "A divine order exists, not in written revelation only, but in the moral relations, the historical development, and the social and political institutions of men." The Psalmist looked up to Heaven, and saw, "the work of Thy fingers, the moon and the stars which Thou hast created." He looked on atmospheric phenomena, and said, "He sendeth snow like wool, and scattereth the hoar frost like ashes."—"He casteth forth the ice like morsels: who is able to abide His frost?" He looked on the earth, and exclaimed, "Thou visitest the earth, and blessest

it, Thou makest it very plenteous "—" the fruitful land maketh He barren "—again, "He maketh the wilderness a standing water, and watersprings of a dry ground." He looked on vegetation, and continued, "The trees of the Lord also are full of sap, even the cedars of Lebanon, which He hath planted." He looked on the animal world, and said, "When Thou lettest Thy Word go forth, they shall be made "—" that Thou givest them they gather "—" Thou openest Thine hand, and fillest all things living with plenteousness "—" The lions roaring after their prey do seek their meat from God." He looked on man: "What is man," he asked, "that Thou art mindful of him, and the son of man that Thou so regardest him.—Thou madest him a little lower than the angels, to crown him with glory and worship."

One Creator, one law-giver, for the creation which He had created. It was a simple faith. It was an ignorant faith; but it was at least a logical faith. Much wiser than those who have acknowledged the first, but denied or craned at the second, severed that which he felt could not be put asunder, and so have disseminated discord and antagonism where all should be harmony and unity. In his simple creed there was no hard separation between theology and science—between moral law and natural law. To him they were one; everything part of one great whole, of which the author and director was the same.

Doubtless he had but a very superficial knowledge—had never pierced below the surface and scrutinized the arcana which lay beneath—never peered into the heavens and discovered the order which regulated the myriad stars, invisible to the unaided vision of man—never detected in the atoms and dust of earth the strange and countless organisms thereof. Doubtless he had never even imagined the innumerable conflicting theories and issues which should puzzle the minds and bewilder the brains, and delight the intellects of those who should attain to do so. But perhaps for that very reason he had formed a juster and truer apprehension than is possible for those who are enticed into the illimitable range of theory and speculation. And thus he had enunciated a great first truth which it is the part of wisdom and honesty to endeavour to keep prominently forward and not to obliterate and abandon. For if His dictum is true of the whole, it must be true of every part which is comprehended in that whole, and it is pride and blindness, not wisdom and righteousness, which would prompt us to set them at variance one with another. For man is a complex being of body, soul, and spirit; they act and re-act on each other; the spiritual life is not complete without the physical life, and *vice versa.*

Unfathomable mysteries there are indeed in the one. Are

there not in the others? Has science exhausted the arcana of creation? is there nothing left to discover? is everything unravelled? has everything been accurately demonstrated? has the book of nature been ransacked? every page opened and deciphered, and all so plain that he which runs may read it? So have some thought from the beginning. Each age has heard the triumphant cry "Eureka." Each age has heard the contemptuous condemnation of that which has gone before; the dogmas of one age have been the fallacies of the next, and the wisest intellect has shown its greatness in the humble confession of a Newton, "I am but a little child gathering a few grains of sand before the shores of eternity." Those whom God hath joined together, man in his pride has ever been endeavouring to put asunder. The ecclesiastic of old anathematised the scientist as a propounder of heresy, and the scientist of modern days is apt to deride the theologian as a mere preacher of effete and old world fables. Theological law and scientific law have been arrayed against each other as if incompatible the one with the other. The one has been exalted in indifference to or in antagonism to the other, instead of each being treated as the correlative or complement of the other; each being imperfect, impotent, and deleterious in proportion as the other is lost sight of and neglected.

Theological truth versus scientific truth—as if the one or the other must have the unquestioned supremacy if not monopoly, instead of each being but a half truth, which together make the whole truth; or each being a half law, together making that of which even the most cultured and learned mind in these days may say with the shepherd boy of Israel, "Lord, what love have I unto Thy law; all the day long is my study in it."

And men have gone astray in proportion as they have swerved from this elementary axiom. Human life in its health, for instance, to use the word in its full and therefore true comprehension and significance, depends upon the fruitful recognition and harmonious dealing with both.

On the one hand, theology, however sure its grasp, however deep its perception, cannot suffice. It is only the half law and cannot do all. How often in the history of the past has the pestilence been recognised as a Divine chastisement for moral or spiritual shortcoming, and the remedy sought only in penitential prostrations and prayers?

And truly so, for we are distinctly told that pestilence is one of the scourges in the Divine hand for human punishment; and effectually so, for scoff and mock as people may at God at other times, nothing begets or stimulates serious thought so much as a widespread epidemic.

But what is this chastisement? No extraordinary visitation of God. Simply people experiencing the natural and necessary consequence of their infraction or neglect of the physical-half law, and, in the misery and death resulting therefrom, being taught what perhaps they would not be so ready to perceive or admit—nay, that which they are obstinately resisting and refusing to acknowledge—the as certain evil consequences resulting from neglect of the spiritual-half law, and that thus they may be led to keep the whole law. And the supreme Orderer and Controller of all things, no doubt, suffers them to become involved therein, in order that it may be, as it were, a parable to convince them of what they are so slow and so reluctant to understand.

God forbid that man should ever ignore such teaching. But the whole remedy is not only spiritual but scientific too. Not only penitence and prayer and amendment of the spiritual life, but cleanliness and drainage and increased and improved sanitary appliances. Not strange incongruous duties, but each forming part of complete obedience to the same law. Not different unconnected laws, with no harmony or coherence between them. And who shall say that answer to prayer and penitence is not given by greater attention to and clearer perception of these things. We are quite right in regarding a pestilence as God's visitation, but we have no right to think that He will only take it away by some special act of His providence in answer to prayer, when He has implanted in us faculties to perceive and capacities to use, powers which He has provided for that purpose, and, by the successful use of which, we may look to Him to guide and bless those who, in faith and humility, seek His direction and help.

It is God's will, indeed, that we should be spiritual, but not only spiritual beings. He has implanted in us capacities for an earthly as well as a spiritual life. And as long as we are here, means us to use them both. It is not enough to be, however, good and holy and humble, we must be practical. We must in this, as in everything else, be fellow-workers together with Him. He will enlighten and guide us. But we must not sit with folded hands. No, nor bow the head like a bull-rush. Nor ever say with Eli, "It is the Lord, let Him do what seemeth Him good."

And so, on the other hand, it is but a biassed prejudiced and imperfect apprehension which under similar circumstances, ignores and ridicules all spiritual significance, and regards things simply from their physical and scientific aspect.

To consider religion with disease pestilence and epidemic is, to some, to mix up things which have no connection.

Defective water supply, insufficient drainage, neglect of

ordinary precautions, scamped workmanship, ignorant design. These are the causes, and the remedy is not far to find: money, engineering skill, scientific and medical talent.

True; but, even if successful, all is not done. "Salus populi suprema lex." True enough; but a sanitary people, and a cleanly people, are not therefore, as a matter of course, a happy people. There are evils besetting us which no perfection of drainage will remove. There are troubles affecting us which the purest water supply cannot wash away, and cravings which the most sparkling streams cannot supply. When "Salutland," of which Dr. Richardson spoke, has been established, even then heavy heads and aching hearts will not cease. Existence, even if thereby lengthened, according to his opinion, to a hundred years, will become a burden in spite of the most complete and sanitary precautions in the world. Moreover, I venture to assert that definite religious principle and active religious practice have a great deal to do with the performance of sanitary duties as regards ourselves personally, and the maintenance or development of them amongst men. Something more than mere self-preservation is needed for the one, and pecuniary interest, or fear of the penalties of human law, for the other.

As regards ourselves, our bodies, as well as our Spirits, are God's; and if He has shewn His care for the former as well as the latter, who are we that we should, from any motives of mental indolence or distorted spirituality, disregard them. "Cleanliness is next to Godliness," says the old proverb. I am bold to say more than that, viz., that cleanliness is part of Godliness; and if religion is knowing and keeping God's law, to set that law at defiance, or to ignore it in one part, is as culpable as in another. There can be no consistent cultivation of the one with any conscious or intentional disregard of the other; and to attend to all that reasonably concerns and promotes the health of our bodies, is as much a religious duty as the same attention to our souls. The old theory that the opposite to this was an evidence of sanctity has been long ago exploded, but we have not as yet arrived at the true converse. To rush to the other extreme and to pamper the body, and indulge in everything which panders to selfishness and sensuality, is not the true converse but the abuse thereof. At any rate, until people realize that dirty habits and neglect of healthful practices are as much sins of commission and omission as anything else, they will never give them the attention which they deserve, which cannot be enforced by law, and which are so easily evaded.

And if so as regards ourselves, how about others? Those

intentional neglects, those deliberate offences against the health of the people, to which so much sickness, misery, and death are due? Plain duties evaded, work purposely scamped and rendered inefficient and worse, people suffered knowingly to live without the most necessary requirements, and under influences which cannot but cause miasma, or kindle, or spread, or aggravate disease, debility, and wretchedness.

Human law has done and is doing much to expose, condemn, and remedy such execrable practices, and, in my humble opinion, no punishment can be too great, no penalty can be too heavy, for those who from some contemptible consideration of greed, or from some wretched indolence, are the cause of these evils to poor and often helpless people. But human law can always be thwarted and evaded, and legal consequences never appeal to or call out the best attributes of our nature. Such a sentiment may be deemed visionary and unpractical outside, but here I venture to put this on a religious basis, and to repeat that, until the human conscience is quickened to feel that such proceedings are deliberate sins against God, for which no amount of Church going, or Chapel going, or religious profession of any sort can compensate, men will not forego the paltry profits which can be gained therefrom, or exert themselves to deliver those who are languishing silently and perhaps unconsciously from them.

But if this is so, mere recognition of and assent thereto is not enough. Nor the assumption that the principle, once admitted, can be easily carried out. God's law is complex, delicate, subtle, and, therefore, to comprehend it, demands continuous and careful attention, or as the Psalmist expresses it, "All the day long is my study in it." Half knowledge is perhaps more detrimental and contemptible than utter ignorance; and while we smile at the ridiculous bravado of Alphonso of Castile, in the 13th century, mathematician and astronomer, who declared "that he could have devised a better way of ordering the movements of the celestial bodies," a similar superficial grasp of a subject is still lurking abroad, and is at the root of half the evils that beset the physical condition of man.

That condition is always altering, developing if you like it. Man's personal wants and habits, his social position with his fellows, must alter according as the means and circumstances of his life alter by the inventions and culture of men.

Man is, personally, the same animal that he was at the creation; but his surroundings and requirements, his enjoyments and acquirements have varied, and will continue to vary with each succeeding generation, and the attention thereunto must, in like manner, be progressive. The usages and customs which sufficed for our forefathers would be distasteful if not

disgusting to us, nay, the sufficiency of yesterday is almost effete to-day.

Moreover, advancing science each day succeeds more and more in tracing effects to their cause, and bringing to light that which has been heretofore enveloped in darkness. That which was vague and mysterious but lately, now is so plain that he which runs may read it. The subtlest poisons are detected now lurking in the simplest substances; and latent, unsuspected chemical changes, developing active agents of mischief to human life, are discovered and demonstrated.

How many errors have been exposed, how many strange paradoxes satisfactorily reconciled? We are tempted to smile at the simple ignorance—the clumsy expedients of our ancestors.

But more (how much more) remains to be unravelled? and to keep pace with the ever-changing progress of men, men must be ever examining, ever learning, ever designing, ever holding communion with men like-minded with themselves in that wide and unrestricted intercourse which has become possible, from which larger and clearer views may be acquired, vexed questions sifted and ventilated, and conclusions arrived at, instinct with valuable results for the present, and pregnant with beneficent issues for the future.

But what are you doing herein? Are you thus unravelling a fortuitous web—A skein evolved of itself by some spontaneous generation, entangled by hap-hazard, the product of mere chance? Or are you forcing the barred doors of nature's treasures and rifling her secrets against her will—convicting her of mismanagement, and intending to undertake the management thereof for the future yourselves?

Or are you engaged in a siege, in which, by sap and mine and persistent struggle, you are advancing upon a citadel which your own increasing strength and cunning shall enable you to master, "vi et armis," in spite of all opposition? Or are you advancing along a track, the doors of which, one by one, an Almighty hand has, as it has seemed good to Him, been opening to you, without whose pleasure you would have been baffled for ever, whose finger is even now leading and directing you which way you should go, and how far and how fast you should go along it.

We have lately read, with pleasure and gratitude, the devout acknowledgment of the Divine Author of Nature, uttered by Sir William Dawson in his opening address at the meeting of the British Association at Birmingham,—"The vastness and the might of ocean, and the manner in which it cherishes the feeblest and the most fragile beings alike, speak to us of Him who holds it in the hollow of His hand, and gave to it of old

its boundaries and its laws." And, as you trace out the conflicting theories, and reconcile seemingly irreconcilable paradoxes; as vague and indefinite processes assume form and purpose, range themselves in order and become elements of a law, mysterious sometimes, but nevertheless distinct, reasonable, efficient; a law which you can demonstrate and define. Do they not indicate a law-giver? One to whom you can say, as you recognise the aim and discover the end thereof, "Lord, what love have I unto Thy law, all day long is my study in it."

Yes, and will you not go one step further, and acknowledge yourselves as "good stewards of the manifold grace of God." Yea, it is a high honour to be the exponent to others of what God has revealed to you. It is a blessed stewardship to be made the agents of imparting to others that which so largely and so intimately concerns the welfare and comfort of their life here.

Homes rendered healthy by the removal or prevention of all that creates miasma, or defiles the "breath of life," by the inculcation of the importance of the habits of cleanliness and order; and these habits rendered possible by the power of demonstration and conviction, causing them to be adopted and practised.

Healthy development of mind and body promoted, the infirmities thereof supported, the sickness thereof mitigated. All that now, unnecessarily, blights humanity, produces squalid forms, pale faces, and debilitated frames, abolished. Men, women, and children rising up and calling you blessed—hailing you as, under God, their deliverers "from the pestilence which walketh in darkness, and from the sickness which destroyeth in the noon-day."

And so we wish you God speed in this your happy work. So we join hands here to-day—men of science and men of theology.

The law which we preach and you lecture, which we proclaim from the pulpit, and you propound from the rostrum, is one. The phases different, the applications diverse, but the source the same, and the ends thereof not antagonistic to nor independent of each other, but identical, viz., the health of that complex being of body, soul and spirit, whom we call man.

INAUGURAL ADDRESS

Delivered 21*st Sept.*, 1886,

BY SIR T. SPENCER WELLS, BART., F.R.C.S.,

PRESIDENT OF THE CONGRESS.

I HESITATED for several days before complying with the flattering proposal of the Council of the Sanitary Institute to fill the honourable position of President of this year's Congress, and to address you this evening. Although a worker in collateral Science and Art, I could not presume to appear before a meeting of sanitary experts as an instructor, and I must beg you while listening to me to consider that we are all engaged in making a joint effort to draw general attention to questions of vital importance to the public health, to diffuse information, to get the people to take an intelligent interest in sanitary matters, and to bring the governing powers into a disposition to give more effectual help in carrying out such reforms as are proved to be necessary by scientific investigators. With the feeling that this is our mutual relation I may proceed, and if I trouble you with the reiteration of some truisms, and the citation of facts already well known to many of you, I trust you will be patient with me in the hope that some of the seed which may be sown broadcast to-night may fall upon fruitful soil; and, if good, may so multiply that it may be sown again and again by others, and in good time influence the multitude.

A great deal of what, if I had time, I should like to say to-night has been already said by one or other of my predecessors in this chair. Richardson, one of the foremost of our sanitary reformers, began by an account of his researches and experiments on the origin of spreading or communicable diseases, and followed by displaying his popular "Ideal of a healthy people." He was, perhaps, the first to make generally known the grounds upon which Owen and Flourens calculated

that threescore years and ten, or fourscore years, should not be the extreme limit of human life; but that old age only begins at 70 years, mellowing down to a ripe old age at 85, and that the natural duration of human life, under perfectly healthy surroundings, ought to be 100 years, and might be occasionally carried on some fifteen or twenty years more. Chadwick, our revered Vice-President, eight years ago, though then almost an octogenarian, showed that he was as exact and earnest as he had always been in the sanitary work to which he has devoted his useful and honoured life. Even now, though approaching his ninetieth year, he still stimulates his juniors by his bright example. Before the end of this year two volumes of his works, speeches, and letters, edited by Dr. Richardson, will be published, and will be prized as the foundation of scientific sanitation, and as a valuable contribution to the history of our own time. Lord Fortescue, who for more than forty years has laboured in the cause of public health with a zeal which involved personal sacrifice, treated sanitary reform in this country in its administrative and legislative aspects. Galton, distinguished in the army as an officer of the Royal Engineers, and not less so in the Royal Society and in civil life, proved that his powers were equal to the wide range of the subjects before us. Then Humphry, honoured alike as practical surgeon and Cambridge Professor, enlightened us by his knowledge of many things which prevent the development of the human body, and lead to disease and too-early death. Rawlinson taught us what sanitary engineers can do by a better system of sewerage, drainage, and water-supply, in preventing sickness and prolonging life. He well said, "The strength and glory of a nation is not in standing armies and ironclad fleets, but in the health, well-being, and contentment of the people." And last year de Chaumont, with extraordinary exactness and minuteness, detailed statistical evidence of the effects of sanitary modifications of many conditions which affect the health of all classes of the population. In the hope that we may assist in the advancement of the grand object which animated these great men, and following the course cleared by them, it now remains for us to consider how sanitary improvements may be carried on still further by the co-operation of investigators, legislators, and administrators.

Any great sanitary improvement of the community must be the result of elaborate co-operation. We must have the combined action of the three great classes of investigators, legislators, and administrators, before we can effect any good result. And if we regard sanitary reform in these three aspects, we find that a great deal of the work of investigation

has been done, and that the work of legislation is lamentably deficient; while the work of administration cannot advance beyond the limits of legislation.

As regards the work of investigation, we may safely assert that it has hitherto been for the most part personal, and that the waste of labour has been enormous. It is only of late that this Institute has come to its aid. Three-fourths of the fifty years that Southwood Smith, Chadwick, Farr, and Trevelyan were at work, they were well-nigh single-handed. Perhaps the foundation of such a body as the Sanitary Institute may be enough for them to be proud of; but more must follow, and it is to be hoped that before long we shall have, for the sake of life and health, an organisation as powerful as that which protects our property and our liberties. The Institute must develope into something grander and more powerful. The Colleges of Physicians and Surgeons have done and are doing much useful work; but the work is done more for the individual than the collective good. Without interfering with them—rather aiding them—why should we not have a College of Health—a College which would show our appreciation of the gift of life and our reverence for the Giver?

But, turning back for a moment, let us glance at what the advanced guards of sanitary science have already accomplished. It is bare justice to them from time to time to recount their services, and while we are encouraged by their success, we shall learn what remains for us to do. We have only to look carefully into the memorial volume of selections from the reports and writings of William Farr, published by the Council of this Institute, at the suggestion of Dr. Gairdner, to find a revelation of the mass of ignorance, prejudice, and folly which our early reformers had to expose, and of the variety and extent of their labours. It is a record which is honourable to all, and to him whose writings it enshrines it may serve as a monument more eloquent and touching than any brass or marble. What did we know of Vital Statistics fifty years ago? It was in 1837 that our Registration Act came into operation, and certainly no one could have more ably worked it or turned it to better purpose than Farr. It was from his Reports that it first became generally known that our death-rate was too high. We now know that the measures indicated, and taken as necessary to lessen mortality, have been so effectual that a large part of the gain of twenty years in the average duration of life in this country since the beginning of this century may be claimed for the registration period; and there can be little doubt that, if the provisions of the Registration Act were more strictly enforced, the prolongation of life would

be greater. Very few even of those well informed in sanitary matters are aware of the large proportion of the population now buried without the cause of death being properly certified. When Dr. Cameron introduced the "Disposal of the Dead Regulation Bill" in the House of Commons, in 1884, he showed that in England and Wales, more than 20,000 bodies in a single year were buried without any certificate whatever of the cause of death. In Ireland, there were more than 4,000 burials under the same circumstances, while in Scotland, in no fewer than 20 per cent. of the total number of deaths registered, the causes of death were uncertified. Even in Glasgow, not less than 9 per cent. of the total number of persons who died in that city in 1882 were buried without any certificate of the cause of death. Having learned the important results obtained by what we must confess to have been very imperfect registration, I desire in the strongest manner to urge attention to the necessity for more strict observance of the provisions of the Act by the public; and for more careful and accurate certificates from members of my own profession—a profession ever ready freely to assist the State when asked for information on any question affecting the public health and welfare.

Since our last meeting one of Farr's fellow-workers—a veteran reformer—has passed away. The name of Sir Charles Trevelyan will at once recur to you, and with it the thought of the vast amount of good he was able to accomplish. The principle underlying all his efforts—that of helping the poor to help themselves—is the right one. He knew that without health they could never succeed, and one of his main objects was to secure health for them in the least objectionable way. The President of the Metropolitan Provident Medical Association will give you some interesting details on this subject in a day or two.

When we speak of the prolongation of life, we think chiefly of the advantage to individuals, their better health, and their augmented power of enjoyment. This is a great deal. But it means more for the State. It may sound well to declaim against the money view of the subject as low and sordid; but it is not to be overlooked when we are apportioning merit for work done. A donation to the community of two or three millions would be looked upon as an extravagance. But what is the fact? During the forty-nine years that registration has been in force, and sanitary reforms have advanced with its annually increased information, about eight millions of people have been added to the population of the United Kingdom. We may fairly credit our reforms with a large proportion of this increase in numbers, and consequently of their money

value. The result on human happiness is not a matter of calculation, but a future industrial census will show in a very definite shape the effect of sanitation in raising the economic value of the population.

How much of this gain is due to the active and useful work of pure sanitation, and how much to medical and surgical work, it is unnecessary for me to discuss; but it would be a censurable omission on my part if I neglected to allude to the coincident progress made in the science and art of medicine and surgery. It would be easy to tabulate figures showing how the mortality of small-pox has been diminished by more universal vaccination; how hospital mortality in general, and in a number of different diseases, has been diminished, especially since the use of antiseptics, and by the improved methods of performing various surgical operations. I must not go into such details and statistics here, but I do claim for the medical profession of this country a considerable share in the gain to the State of increasing numbers of more healthy subjects. We cannot be far wrong if we put the average duration of human life in Great Britain half a century ago at about 30 years; now, according to the healthy life table, it is 49 years. the population in less than 50 years increased, as I have said, by some eight millions. Each individual of these millions was worth to the State, as is calculated, about £150. Say that only two millions out of the eight millions of increased numbers were the fruit of sanitary and medical work, their economical value was at least 300 millions of pounds, and that a clear gain. To this we must add that the productive powers of the population depend on labour, and that labour depends upon health. Let sickness come, men are disabled, their labour ceases, and the produce of labour is lost. Formerly it was calculated that a twenty-third part of the population was constantly sick, and the products of all that labour for the time necessarily withdrawn. A great deal of this sickness has been altogether prevented, and the duration of that which comes in spite of sanitation is lessened. Happily did Richardson give form and expression to the proverb, "National Health is National Wealth!" and well may Froude follow with his paraphrase, "The *Commonwealth* is the *Common health*, the common wellness," and add "No nation can prosper long which attaches to its *wealth* any other meaning."

Since the formation of the Sanitary Institute, although the progress of sanitary science has not been as rapid as we desire, yet its advances have been more readily measured. The annual meetings, the presidential and sectional addresses, and the papers read in the sections, have brought important

movements under notice; and as the Congress migrates yearly to new places, its information becomes more varied and trustworthy. We gather assurance of the generally improved moral and physical condition of the people. We find that infant mortality is lower; that education becomes more satisfactory as the principles upon which it should be conducted are better understood; that those who work are better paid, get wholesomer food, and dwelling-places more fit for human habitation. Increasing intelligence has given a claim to political rights, and developed an interest in political questions. Thrift is more common, and savings banks more used. It is barely 50 years since the general introduction of savings banks; yet by the last returns more than 45 millions of money stand to the credit of depositors in these trustee banks—while in the Post Office Savings Bank, only established in 1861, more than 44 millions belong to the industrial classes of the United Kingdom. Thus a total of more than 90 millions now represents the results of the thrift of the people during the past half-century. And co-operative associations show more and more, year after year, how well and quickly, when men begin to learn that life and health are worth looking after, they find out the means of taking care of themselves and of their material interests; and I think I am not going too far when I say that this Institute may be congratulated upon the success of what it has done towards to the recent diminution of drunkenness and crime.

With all this encouragement we may look hopefully to the future, and consider what are the most pressing subjects of inquiry, and which is the way of conducting our investigations that gives the greatest promise of success. The field is vast, but, as we have seen, it is not impenetrable; and obstacles are sure to yield to steady and well-directed attack. Facing the difficulties, what is our attitude? Our representative meeting here manifests that we are numerous; our Institute shows a certain amount of aggregated working power; but it is more a nucleus than a complete organisation. It may be effective as an investigating, deliberative, consulting, and examining body, but it has no directorial power, no agency for carrying out practically the measures which its collective wisdom has indicated. Crowds of sanitary volunteers hover about it, and make desultory attacks upon weak points, often with much waste of energy. "What we want is a central power," as Lord Brabazon wrote last month in the *Times* (August 30), "which shall regulate and control local action, so that no town or locality shall be able to neglect the public health, or, in endeavouring to purify itself, shall poison its neighbour. We

want a power which shall take a bird's-eye view of the whole question, and work not for the good of one locality only, but for the good of all." This is what we want, and what we must have some day. But, while we are waiting, an interim organisation of deliberative and administrative agency should be set up, as if a Ministry of Health were in power. The Local Government Board, too, with all its official completeness, like ourselves, may recommend, but cannot command. There seems to be a link missing between the knowledge of what is right and the power to apply it. This link is a Minister of Health. We have now only the elements of the organisation which I suggest; its formation is matter for consultation and arrangement, and probably might be accomplished without much delay. In the meantime, what are WE to do? The last generation has done so much with means less efficient than we have at command, that we ought to do more than emulate the past. This Institute, united with the Parkes Museum, is bound, in my opinion, to induce all the others to make not only common cause, but joint action; or, failing in this effort, it may, by increased activity, in a short time cover the ground which they now occupy. This would at once make plain the folly and waste of division. This process of amalgamation has already begun by the union of the Parkes Museum with our Institute. The National Health Society, the Ladies' Sanitary Association, the Cremation Society, the Smoke Abatement Institution, and others of a like kind must follow; while such societies as that of the "Medical Men qualified in Sanitary Science," and the "Society of Medical Officers of Health," would find themselves more fitly placed and more usefully employed as sections of one united body than they now are. The Conference of Medical Officers of Health to be held to-morrow afternoon is, I trust, the beginning of a closer union between this important class of officers and the Sanitary Institute.

The active working of such a large group of philanthropic societies shows how constantly the interest in all sorts of sanitary measures has been increasing during the last twenty years, and how much it has been in the power of such feebly-supported societies to do. The official lists of names connected with them proves that there is nothing narrow nor sectarian in the way the work is carried on. And in calling to mind the beneficent influence that has been exercised by the Society of Arts through their publications and exhibitions, by the National Health Society through their pamphlets and popular lectures, by the homely instructions and friendly visitations of the Ladies' Sanitary Association, by the manifestation of sympathy of class with class in the efforts made to secure recreation grounds

and open-air spaces, so striking to every one who walks along our streets and suburbs, and by the greater comfort which our smoke abators have secured for forced town-dwellers, we ought to make grateful recognition of so much useful service. Our great effort at present ought to be the concentration of working power and its economical direction. With this object attained, it will not be difficult to explain the motives for special contributions, and to collect them from a public which seldom turns a deaf ear when appealed to rationally. There are many investigations which require much time, which cannot be conducted by individuals, and which are costly. The Institute, with adequate funds, could form its commissions, send out its health challengers, have its own laboratories, museums, deliberative councils, exponents, and consultants—and all this not interfering with, but rather in aid of, recognised privileges or established authorities. If money enough were forthcoming, more than I have suggested could be done, and I cannot believe that we shall fail simply for want of money. Take the sum total of all the subscriptions and donations received by the whole group of Sanitary Societies, and how very small it is compared with the amounts thrown away daily upon the most trivial objects, and with the many millions of pounds worse than thrown away in unjustifiable wars! It is not the least of the gain we hope for after each Congress, that more direct and repeated enforcement of the conviction that individual advantage is bound up with all that improves the national health, will lead to more thoughtful discrimination, and more liberal support of worthy objects—that new labourers may be called into the field—that the old hands may be invigorated—and that wealthy philanthropists, who justly value their money by the amount of good they can do with it, may learn how, by an expenditure insignificant to them, an incalculable amount of good may be done, and how easily they may assist in the efforts to make our people healthier and happier, wiser and better. In this country the most brilliant instance of what I mean is the munificent legacy of Erasmus Wilson to the College of Surgeons, amounting to nearly £200,000. In America, a citizen of Baltimore has endowed that city with a University and Hospital by a bequest amounting to nearly a million and a half of our money. In New York, the Medical School of the Bellevue Hospital has been presented, by a wealthy inhabitant, with a pathological laboratory; and the College of Physicians has been provided with new buildings affording the best means of teaching and research, at a cost of £200,000 by Mr. Vanderbilt and members of his family; while an unknown donor has endowed a laboratory for the University Medical

College of the same city with the sum of £20,000. Well might my dear old friend Fordyce Barker last year, in his retiring address as President of the New York Academy of Medicine, rejoice in this growing tendency to regard wealth as a "trust to be used for the benefit of humanity," and we may join with him in the belief that an endowment of at least a million of dollars will be provided by some of his wealthy fellow-citizens so as to complete the requirements of an Academy of Medicine on a scale never yet attained on this side of the Atlantic. Such examples as these are pleasing evidence that, although this is said to be an age of machinery, of money getting, of selfish indulgence, of thoughtless waste, still it is an age in which men are not wanting who have proved that they well understand the responsibility entailed upon them by their riches—whether derived from their ancestors or gained by their own successful labours—and who can find their truest satisfaction and reward in endeavours to benefit their fellow-men and in the exercise of a careful foresight, so that the good they do may be continued and increase as time goes on.

In studying the various subjects to which the Institute has given attention, and the investigation of which it is still prosecuting, they may be conveniently arranged into five groups: 1, those which relate to the training and health of the population; 2, to their social comfort and well-being; 3, to the prevention of disease; 4, to the care of the sick; and, lastly, those relating to the disposal of human refuse and remains. Impossible as it is even to recall those subjects to your minds, there are a few points upon which I cannot refrain from a word or two of comment.

1. So far as concerns the mental and physical training of children, and giving women the option of other occupations than those of domestic life, I see no great cause for alarm. It is an age in which education—at any rate for the middle classes—must be pushed far beyond the limits which our fathers thought wide enough for us. Mere rule-of-thumb work is almost out of date, and there are so many industries in which scientific knowledge and exactness are requisite, that the want of early education cuts off a young man's chances of advancement. To engage in most of the recent applications of steam-power, electricity, magnetism, and chemistry—to be available in carrying out the complexities of engineering science—a workman must be something more than a mere machine. He must have head as well as hands—brain as well as muscle; and as uneducated brains are not worth more in the labour market than untrained muscle, we must be content to make some sacrifice in the culture. While we pity the few who

fall in the struggle, we must remember that there is no chance for those who stand still.

As for the outcry about the dangers from women taking up men's work, it is breath wasted. A great many failures will outweigh a few successes, and bring the balance right. For my own part I think women capable of a great deal more than they have been accustomed to do in times past. "To suckle fools and chronicle small beer" surely cannot be the chief end of woman. If overwork sometimes leads to disease, it is more morally wholesome to work into it than to lounge into it. And if some medical practitioners have occasionally observed cases where mental over-strain has led to disease of mind or body, I cannot deny that I also have at long intervals seen some such cases. But for every such example I feel quite sure that I have seen at least twenty where evils equally to be deplored are caused in young women by want of mental occupation, by deficient exercise, too luxurious living, and too much amusement or excitement. After marriage, the domestic duties which are the pride and happiness of most English women keep the great majority of them free from the very slightest desire to encroach upon any part of the work or occupations of men. A few exceptionally gifted individuals may rival their fathers, husbands, and brothers in music, the fine arts, or literature; and I know no one who would seek to discourage them. If some of them, and if even a larger proportion of unmarried women, chose to struggle for success in one or more of the learned professions, or in political life, while I for one should not be at all disposed to oppose them, I cannot regard the attainment of their object in large numbers as likely; or, if secured, without grave apprehension of serious evils. The training of the young, and education, specially in its early stages, always has been in the hands of women, and is better left there. If they do this work well, I can hardly imagine a higher or wider sphere of usefulness. As to the women of the middle classes, if we were to see them in this country doing, as many of them do in France, the work of the men, it might not do any harm to the women, but it would probably lead to the multiplication of a class of idle, intemperate, dissolute men. I still hope that, in our own land, man will ever work for woman, and woman ever be the solace and comfort of man, his good spirit, his better self,—"mein guter Geist, mein besseres Ich."

Again, we have heard of late much about over-pressure from work in schools. This is one of the novelties of our time. No doubt it exists, and I think that it may in part be traced to some of our sanitary success. We have reduced the mortality of early infancy. Many children who would formerly

have died off hand are now saved, and find their way into the schools. They are the survivals of the least fitted. They live, but they are not strong; not so strong as the average. They have to submit to the same routine, and to be forced up, if possible, to the same standard as the rest. But the effort is too much for them. Their frames are not hardy enough to resist the mental strain. They show all sorts of nerve symptoms, disappoint the teachers, and are the types brought forward as victims of the system. The vice of the system is that it is indiscriminate. There is no revision of the recruits, and the tasks are not apportioned to the feeble powers of sanitary survivors. This is an evil which will remedy itself in time by the growing up of a larger proportion of strong children, and the present difficulty may be got over by a little patience and moderation—a little more regard to sanitary logic. The children must have training before education, and must be put upon something even less than a half-time system.

2. Of the many things which affect our comfort and well-being, some are national, some local, some residential. One of the most potent means of influencing the sanitary condition of a country is the judicious regulation of its forests. In Great Britain the Government all but ignores the subject of Forestry. There is no school for teaching the science. Every proprietor is obliged to shift for himself, or to seek foreign help. And yet by looking at the state of things in Upper India, Palestine, and Russia, we may see what mismanagement leads to. Almost everywhere, man's ignorance and recklessness has worked evil by destruction of the forests. He has deteriorated the condition of the climate, taken away the productiveness of the soil, brought on famine and pestilence. We are not suffering to this extent. But negligence and mischief are inseparable, and to urge measures for the preservation of any climatic advantages we may still have, and the restoration of those we have lost, is assuredly work pertaining to a Sanitary Institute. My friend, Dr. Lyons, when in the House of Commons, did good service in pressing the importance of tree-planting, especially in Ireland, upon the attention of the Government. Unfortunately, he is no longer a Member of Parliament; but he still continues his efforts to prove that by well-directed management the whole of the timber and forest products now obtained from abroad, at an annual cost of some 32 millions sterling, might in time be furnished by our own land and labour, and that this economy would be attended by no less desirable changes in some of our climatic conditions.

Passing from national forestry to public gardening, I should like to say a good deal about the planting of trees in our towns,

the improvements in street architecture, and the formation and better arrangements of open-air spaces for exercise and enjoyment; but this part of the subject will be treated by Lord Brabazon in one of the sections, and is certain to lead to an interesting discussion. If I were to enter upon the wide field of the residential influences which influence our health and comfort I should detain you till midnight. And I must pass on, although the ventilation of our houses, school-rooms, and places for public meetings and amusements is a very tempting theme. But this also will lead, I trust, to discussion before the Congress closes.

3. In preventive medicine, the great event of the year has been the publication of Pasteur's views on hydrophobia, and his treatment of it by inoculation. I must not anticipate the reports of Commissions still sitting; but, in connection with what I have previously said, it is worth bearing in mind that, astonishing as Pasteur's own personal work has been, he has all the way through been adequately seconded. He has found means and material forthcoming, suitable accommodation has been provided for his investigations, he has been buoyed up by judicious encouragement, and he has never been obstructed by legislative impediments. He has been a benefactor to his country and to the world in many ways, and his services have met with a just recognition. But we must not be too sanguine, form unreasonable expectations, nor jump to irrational conclusions. As he himself wisely says, in speaking of his attempts to neutralise the poison of hydrophobia, we must wait and see the results of what has been done before we can test the value of the practice. I accept the principle upon which he acts, and believe that those who are following his lead may outrival him in the good they confer upon mankind. We have made a great step in advance, and I can see that, before long, time will reveal to us in unexpected ways the importance of what has already been done. Unanimity of opinion upon questions still in the hands of experimenters need not be looked for, but we must all admit that in the cosmopolitan movement for the erection of Pasteur's hospital and laboratories we have another proof of what I have before insisted upon, that help is sure to be given upon the evidence of good work to be done.

Not content with endeavouring to prevent the spread of infective and contagious diseases, some of my friends think we should aim at their complete extinction. And if due and complete notification of every case of such disease could be ensured, and its specific germs limited in action to any particular locality, and the sick were properly isolated—in some cases subjected to specific treatment, or to inoculation—and all germs and germ-

carrying material within reach were destroyed by fire—then, so long as all these precautions were observed in any district, its safety might almost be guaranteed. But until the time arrives when there will be a universal attempt to stamp out specific diseases, infective material will be always hovering somewhere around us and making incessant protection necessary.

4. Yet, even if we were to realise the most enthusiastic visions of one of my most imaginative predecessors, and could cycle through the greater part of our century of life soundly and pleasantly, accidents must overtake some of us, and decay and infirmity must come sooner or later. This is a theme which gives play enough for intelligent thought. The rich when sick can afford the luxury of skilled attendance, and can hold out inducements enough for men of capacity to devote themselves to the study of medicine and surgery. But what are the poor to do? They can never alone, or without some aid or combination, afford adequate remuneration. Medical relief, as in legal phraseology it is called, is the first step to pauperism. Self-help in this matter is one of the first steps to independence. Provident dispensaries, giving members the right to attendance from medical men of their own choice at their own homes—the opening up of easy access, by small money payments, to the coveted advice of hospital staffs, and the foundation of clubs and cottage hospitals on sound principles, are among the best means of meeting the requirements of the sick poor. Our great establishments will always be needed for accidents and severe diseases which there is no possibility of treating successfully in cramped and ill-supplied homes. But hospitals do not necessarily pauperise. The very poor can well accept the care in them as a gracious gift, while those who have something to spare always can, and sometimes do, make a thank-offering. But on this subject you will have the advantage of hearing more in one of the sections from Mr. Bousfield and others who have studied it with care, and to them I may confidently leave the task of suggestion and discussion. Only on behalf of those who have had disease, who have been rescued from its immediate dangers, and are in a state of convalescence, with appetite, strength, spirits coming back slowly, and creating a craving for fresh air, and a longing for the few idle days so necessary to perfect recovery, I wish to impress upon all who hear me the importance of convalescent homes. They are springing up in numbers, but more are wanting to complete the work of our City hospitals. Many patients come to them from the country and return well to the country. But what is a poor town cripple now to do when he is relieved, and hospital atmosphere bars his recovery of health? And now that the urban population is yearly augmenting in such a rapid

manner, this necessity for providing for country convalescence is more and more urgent. The philanthropic sanitarian has something more to do than to fit up wards for the sick man to lie down in; he must see that in due time he may get the strength to "take up his bed and walk." If we cannot do miracles we may complete our charity.

5. Even the best regulated communities are encumbered with things which they must get rid of—human refuse, human remains. The one can be dealt with as best suits public convenience, but the other must be treated with reverence as well as security. In our "Transactions" already published, and in the forthcoming papers and discussions, you will find as much as can be told of what has been done through our instrumentality, and of the happy results that have followed. And if I may judge from the titles of promised papers, with illustrious names appended to them, upon the various aspects of sewerage, draining, the supply of water, ventilation, the purification of town atmosphere, lighting by electricity, and the extended application of gas to domestic purposes, this Congress will rival any others in the importance of the subjects brought forward. As regards the question of the disposal of the dead, I may refer you to a lecture of mine, which has been placed in your hands, with remarks upon it by Sir Lyon Playfair, Dr. Cameron, Sir Joseph Fayrer, and Mr. Seymour Haden, with two of the last letters written by the best of the Shaftesburys. Public opinion has been veering round since the publication of the Charge of Sir James Stephen. A custom known to be not illegal will be adopted by many who have hitherto been deterred by the fear of illegality; and the Society which alone in England gives facility for it, is ready to perfect its accommodation, or to give place to any administrative body upon a wider basis.

When we come to speak of the question of Legislation we, as Sanitarians, find ourselves in the same plight as the rest of the world loaded with good intentions. The waste of time and energy in Parliament in party struggles has banished all possible home legislation. We must bide our time, assured that, when this crisis of angry discussion of political complications has passed, the turn will come for practical measures. We shall then settle down to a calm consideration of what is really wanted, shall have our chance of being heard, and probably get a good deal of what we ask for. Our demands will appear so reasonable, our work so useful, and our plans so feasible, that no Committee will have the heart to suppress them, no Parliament the churlishness to refuse them. Only let us be prepared for the occasion, have our subjects chosen, our evidence forthcoming,

our arguments marshalled, and our advocates ready. We shall have ourselves to blame if we do not make sanitary legislation the popular legislation of some sessions near at hand.

In his address to the last annual meeting of the Institute Captain Galton remarked that, "if legislation is not to be ridiculous, it must be accompanied by increased knowledge in sanitary matters on the part both of the persons charged with administering the Sanitary Acts as well as of the public themselves." This is the key to the whole subject of sanitary legislation. The various classes of persons affected by sanitary measures, or concerned in carrying them out, show different degrees of sanitary knowledge, from the zero of ignorance on the part of the public, the confusion of local boards, the self-acquired information of district surveyors and inspectors of nuisances, the results, whatever they may be, of a course of hygienic medicine among the medical inspectors, up to the accumulated science of the Institute and its allies, and the acquired experience of the Local Government Board. The one fact that stands out clear above all others is that there is no definite channel by which these stores can be disseminated and employed for instruction. The course of lecture given by the professors at the London Colleges and at Netley are only intended for the use of medical students. There is no available public means of instruction in matters relating to health for the large body of surveyors, sanitary inspectors, and others whose actual duties are connected with public health; and nowhere at the present time is any systematic instruction given in practical hygiene to the general public. In the Report of our Council for this year it is stated that "the number of candidates for the examinations still continues to show a very rapid increase;" but it was only this year that, for the first time, a special course of lectures was arranged by the Parkes Museum to suit the requirements of persons preparing for the examinations of the Institute and other bodies which grant Certificates. These lectures were given by well-known authorities, and no fewer than sixty-three candidates entered for the course. This alone shows how fully justified Captain Galton was in making this further observation: that if the Sanitary Institute is to fulfil its functions of diffusing knowledge in relation to sanitary science, "it must not be content with holding periodical examinations; it must develope its educational character still further, and it must afford opportunities for students to qualify themselves for these examinations by providing lectures on practical sanitation, and by furnishing laboratories for research in sanitary matters." As regards the public, it will no longer do to trust to the voluntary efforts of

the National Health Society, zealous and worthy of all praise as they have been. Such work may be suspended at any moment; and to be certain and effectual must be undertaken by some public body in an orderly and persistent manner. The ear of the public can be easily reached by suitable addresses and house-to-house visitation; their curiosity excited and their minds enlightened by the objects exposed for examination and explanation in museums. The Parkes Collection will inevitably grow into great importance, and arrangements can be made to secure its utility. But though teaching power can never be wanting among our members, the puzzling problem is how to bring it to bear directly upon the masses. This is a point upon which I confess myself unable to give a prompt opinion. As one for solution by our collective wisdom it stands second to none. Yet when we have instructed the public and embodied our contingent of qualified agency, how are we to make sure that the agents shall act efficiently upon the public? It can never be done without elaborate organisation; and no organised body can act without full legislative authority, and then only under a responsible chief. If it be expedient to have a military medical staff, and a naval medical staff, with their grades of officers and all-powerful directors-general, for the comparatively small bodies of the combatants, why should there not be for the much more numerous civil subjects a civil medical service, equally authorised and as honourably appointed? Such a service would form an important department of a Ministry of Health.

I have taken up a great deal of your time, and I must not presume much longer on your kind indulgence. But there is one matter which I must speak of before concluding, and that is the importance of our having the unsectarian assistance of all religious teachers. Sitting as we do here under the shadow of the hallowed Minster which is the crowning and significant glory of the ancient city of York, one cannot but recall to mind how for successive ages its ministers have been the benefactors of all who came within the sphere of their action. In times of ignorance, they spread light around them. In times of distress, they gave succour to the needy and shelter to the homeless. In times of sickness and pestilence, they were ever ready, at their own risk and peril, to visit either castle or cottage, with consolation for the troubled mind and remedies for the tortured body. And now, in these later days, they, and others allied with them in the same holy work, come amongst us laymen, trained up by them in the spirit of Christian charity, to second our attempts to work the good of the people, to instruct themselves in the principles of our science, and to add the benefit of their wisdom

and experience to our efforts, with as much zeal and devotion as were ever displayed by any of the bygone generations of their revered predecessors.

With such objects in view, actuated by the same spirit of good-will to mankind, and impelled forward by an equal energy, we may promise ourselves the attainment in due time of our desired end—that of contributing to the real and stable greatness of our country, by giving to it a healthy and long-lived population; for we may rest assured that, in the words of Froude, "A sound nation is a nation that is composed of sound human beings, healthy in body, strong of limb, true in word or deed—brave, sober, temperate, chaste—to whom morals are of more importance than wealth or knowledge—where duty is first, and the rights of man are second—where, in short, men grow up and live and work, having in them what our ancestors called 'the fear of God!'"

The Very Rev. the Dean of York proposed a vote of thanks to the President for his address, and said that to endeavour to criticise what Sir Spencer Wells had said would be an impertinence, and to endeavour to supplement it would be ridiculous. The Very Rev. Dean could only, therefore, ask them to join with him in thanking the President for the very able and exhaustive address which he had given them that night, and the best evidence of their thanks would be to pledge themselves to read very carefully the address they had listened to, which it was impossible to grasp at one hearing, and endeavour as far as they could give it practical effect. What the President no doubt wished was, not that they should merely pass a formal vote of thanks for his address, and not only that it should interest or instruct them, but that it should be productive of some definite action in the future. The President had mentioned the two channels in which that action might flow, the legal and the personal. As regarded the legal channel, no doubt it was their duty to make an effort to get beneficent laws passed as speedily as possible; but the prospect of legislation was not very encouraging. Legislation itself generally did not seem to make very rapid strides in the House of Commons, and the Dean did not see himself that there was any prospect of the way being sufficiently clear to enable the carrying out of beneficent legislation which would accomplish any good to be brought to the front. As Sir Spencer Wells said, if they thought it the right thing to do, they must agitate, and never be content until the measure they desired was accomplished. It was an old saying, "while the grass is growing the steed is starving," and if their only hope of improving health was by legislation, he thought there would be a considerable increase in the bills of mortality before that came to pass. He did

not wish to speak disrespectfully of the power of the law, but he always felt that somehow or other things in England on the whole were carried out much more effectually eventually, and much more speedily, apart from the law. Many things he had seen in his day which seemed to almost defy the law had been overcome by the power of influence. There was in the English character a wonderful quality of sound common sense, though it might be a little difficult to arouse, and though there might be reluctance on the part of many to give up their old stereotyped prejudice, and adopt what were called new fangled ideas, yet sooner or later the good common sense of the English people, if they were convinced a thing was right and rational would accomplish great things without the aid of legislation at all. He illustrated his meaning by reference to the discontinuance of duelling in England, and to other social and moral reforms. Years ago it was thought that drunkenness could only be restrained by legal enactments, but the Temperance movement, which had made wonderful progress, had been carried on much better than would have been the case under legal enactments, and more happily apart from legal proceedings. While they did all they could to promote legislation, let them do all they could by their own influence and attention, and by their own efforts, to carry out reforms amongst themselves. There was, he thought, a certain amount of laziness in asking legislation to do everything for them, and he believed that if people would only study such matters as sanitary laws and regulations for themselves, and carry them into practice, a greater advantage would be obtained than by waiting for the work to be done by legislation. In conclusion, he asked them again to join him in heartily thanking Sir Spencer Wells for his admirable paper.

The Lord Mayor of York, in seconding the proposition, said the President had presented them with a remarkable array of facts, which it would be impossible for the most perfect listener to remember, however they might be impressed with that painstaking address. The subjects referred to would dwell upon their minds, and increase the interest that attached to the Sanitary Congress. His lordship acknowledged the beneficent work which had been done by the Sanitary Institute of Great Britain, and said it was gratifying that eminent scientific men should visit the towns of the Kingdom, and, by their influence, secure the recognition of the means they suggested for the promotion of the national health.

The proposition was carried with acclamation.

Sir Spencer Wells, Bart., the President of the Congress, in reply, said a vote of thanks carried in such a meeting as that was quite enough to repay him for any little trouble taken in preparing his address; and still more would he be repaid if anything he had said made them more in earnest in helping to promote the health of the people.

SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

ADDRESS,

By Prof. F. de Chaumont, M.D., F.R.S.

PRESIDENT OF THE SECTION.

It has been the custom, since our first Congress, and following older precedents of other societies, for the Chairman of each section to deliver a short address. I say advisedly a *short* address, for it is abundantly manifest that if he is to air his own eloquence and erudition in a long one, it can only be at the expense of others who have given much time to the preparation of papers, which they naturally are desirous of hearing properly if not exhaustively discussed. The time at our disposal is all too short for the work undertaken, and we are within measurable distance of a change in our arrangements, by which we must have the different sections sitting simultaneously throughout the entire duration of the meeting. This is what is done at the British Association, the British Medical Association, and other kindred institutions. The question of the utility of such addresses has been much discussed, and opinions thereon are divided. When the address is bad in matter and tedious in delivery, then it is an unmixed evil. But to suppose such a thing possible would be to pay but a poor compliment to the Council of this Institute, in whose hands the selection of the Officers of the Congress lies. And this reminds me of a duty which I have to discharge, namely, to thank the Council for the honour they have done me in placing me in this position, an honour which I feel all the more keenly that it is the second time it has been conferred upon me, the former occasion being at the Exeter Congress in 1880. I am quite sure that I was most successful on that occasion, at least in so far as brevity went, for I verily believe I gave the shortest address on record. This I trust will inspire you with

hope that I am not likely to inflict all my tediousness upon you. Before going further let me take the opportunity of welcoming you to this section, and of expressing a hope that we may have good and thorough discussions on the excellent papers about to come before us. Let me also point out that we do not expect silence from our lady friends; on the contrary, we hope they will take an active part in the proceedings,—for there are many points which are best understood and best explained by them, and we men, although naturally arrogant, are not always above taking a hint from the opposite sex.

The title of our section is that of "Preventive Medicine," or rather "Hygiene and Preventive Medicine." It may, perhaps, be well to consider what these terms mean, and what we are expected to do or to concern ourselves with. The meaning of Hygiene is now pretty well known as the art of preserving Health, although the origin of the term is rather obscure, few perhaps having cared to trace it beyond the fabled daughter of Esculapius, by which myth I feel pleased to think that a compliment is being paid to Medicine by making Health its daughter. It certainly has not always been thus in more senses than one, for health is very far from favouring those who are continually consuming drugs, whilst medicine has not infrequently been deprived of what it has been justly entitled to, namely, credit for the efforts its votaries have made for the preservation of health and the checking of disease, even when against their own material interests. But what, you may ask, is the meaning of "Preventive Medicine"? Is it preventing disease by physicking people? or, Is it to prevent the doctors from physicking people? Both of these proceedings might have their advantages, but they do not really explain our meaning. In the good old times, when the smuggler was a more common and (at this distance of time, at least) a more picturesque object around our coasts, the Preventive Service was in every one's mouth, and its duties were well known. Those duties consisted in preventing the introduction of contraband material into the country, material which it was believed would undermine the financial constitution of the country. So it is with our Preventive Medicine: it is a service the duty of which is to prevent the introduction, the slipping in *(einschleppung)* of contraband material into our bodies and undermining their constitution. Its functions are as old as, nay older than, history itself, although its development into systematic usefulness is a thing of yesterday; but so rapid has been its development that we even take upon ourselves to talk of the *science* of Preventive Medicine, hurrying up the question a little in our pardonable eagerness to progress. It must be

admitted that a science, rightly so-called, is a very serious thing; it means a state of knowledge of causes and effects, precedents and succedents, antecedents and consequences, such that we may, with given data, confidently predict a result that shall never fail us. Tested in this way, how much true science have we got? Of pure sciences we have only Logic and Mathematics; and of these probably the first is the only one that we can call absolutely true, in the sense that propositions may be stated so that there may be no loophole of fallacy or ambiguity —the quantification of the predicate has settled that. But in Mathematics, which are more concrete than Logic, we find here and there certain ambiguities, certain irregularities of result, not indeed of any practical importance, but sufficient to show that we have not got to the root of the matter yet. Certain formulæ, which are sound for nearly the whole of a series, fail perhaps in one number, say the second, and are good for all others. Take again a case familiar, at least in name, to everybody, viz., the squaring of the circle. Very few people, not mathematicians, have probably any idea of the meaning of the expression. It means ascertaining the exact ratio that the circumference bears to the diameter so as to be able to determine the area with rigid accuracy. Of course we can get sufficiently near for all practical purposes, but the absolutely accurate determination is impossible. Professor de Morgan, in his amusing "Budget of Paradoxes," mentions that he was visited by a clergyman once, who remonstrated with him for taking up valuable time in discussing a subject that was so simple. "You want to square the circle," he said, producing from his pocket a piece of string with the ends tied together; "here you are, here's a circle, and," pulling the string into four corners, "there's a square; what more do you want?" But even more remarkable is what Pascal recounts of the Chevalier de Méré, who was the first to solve a problem in Probabilities. Pascal says of him: "if he had only known a little geometry he would have been perfect," but he never could be brought to understand the fundamental axiom that a line was that which had length without breadth. We talk of an all-round man, as expressed in Latin, "*Totus, teres, rotundus*," a character which in its highest perfection would be represented by a perfect sphere. But such perfection is ideal, and in all human spheres there are rifts and flaws, the existence of which, however, does not invalidate the abstract idea. We may, therefore, feel assured that in spite of all shortcomings on our part, partly arising out of inability to appreciate the essential points, but largely from actual ignorance of facts, we are entitled to speak of a science as existing, even although we may be most imperfectly acquainted

with its laws. This imperfection becomes all the greater when we have to deal with subjects which are more and more removed from abstract principles, and are consequently more and more complicated in their action. And when we come to consider a subject like Preventive Medicine, whose existence depends upon the previous existence of other sciences, themselves confessedly imperfect, the difficulty becomes greatly enhanced, and the effective working on sound scientific principles seriously hampered. It must be quite obvious that progress in this direction is governed by our previous knowledge of the nature and the causes of disease, and that while these remain obscure, their prevention must be obscure too, and at best be reached in an empirical and haphazard way.

People are inclined sometimes to reproach the medical profession for not knowing more on these subjects than they do; but this reproach is not very just. In the first place, the profession as a whole consists of men who work hard for their living, and have little or no time for scientific inquiry, although it may still be said to their credit that even some of the hardest worked have found time to add valuable contributions to the sum of medical knowledge. In the second place, the inquiries themselves are exceedingly laborious and difficult, such that no one man or set of men could possibly carry out; and it not infrequently happens that it is only after a long series of observations, which had apparently but little individual significance, that the truth is perceived at last, and some clear-headed worker steps into the inheritance and enjoys the renown which is the outcome of the conjoint work of a former host of obscure but earnest labourers. Often, too, the eye of genius can penetrate the future and see, as in a vision, what can be proved and reduced to concrete fact only by long years, if not generations, of work, requiring for its carrying out methods and appliances utterly undreamt of when the idea was first shadowed forth. It is thus that we can trace a perception of the principles of modern pathology and practice in the writings and speculations of men of former ages, whose genius seemed capable for a moment of lifting a corner of the veil which concealed the future from the common eye.

The germ theory of disease and the principles of antiseptic treatment, now so successfully applied in surgical practice, were floating in the minds of men long before Sir Joseph Lister so happily reduced the theory to concrete fact and was the means of revolutionizing surgical practice and rendering it possible to extend to suffering humanity, not only relief, but means of cure, which we had hardly dared hope for no long time ago. Again, with regard to the germ theory of disease, which seems

now to hold out fair promise, the recognition of its possibility was present to the minds of many, not only long before the days of Koch, but before the means of carrying out the investigation existed. We owe the discovery of the first *microbes* (as it is now the fashion to call them, the name meaning merely "minute life") to the genius of Leuwenhoek, in the 17th century; but it was not until well on in the present century that the improvements in the construction of the microscope permitted the inquirer to enter upon the vast field that seems now to lie open. Those who have followed the development of the question during late years know what extraordinary strides have been made, and yet we are as it were merely hovering about the gate, and have barely entered the field at all. Some who have got within the gate astonish us with their account, more or less confused, of the wonders to be found within, whilst others still stand outside on the beaten track, crying out that there is nothing in the field and that all is vanity.

There is no doubt that we are bound to receive with all caution statements on so important a subject as the causation of disease, but to take up a position, as some have done, and deny the possibility of such and such a phenomenon, or group of phenomena, being concerned with disease causation, is to assume an attitude of infallibility, not only ridiculous in itself, but antagonistic to true progress. Thus, although it is not yet possible to admit, as proved to demonstration, the connection between certain microbes and certain diseases in the way of cause and effect, yet the connection is so remarkable, in some cases at least, as to lend an air of verisimilitude to the view.

In 1879, at the International Medical Congress at Amsterdam, there was a discussion in the Hygienic section on the subject of the examination of drinking water. I maintained the necessity of supplementing the chemical by a microscopical examination in every case, in the hopes of obtaining in that direction information which chemistry seemed incapable of furnishing. Considerable experience had taught me what chemistry, in its existing condition as a science, could and could not tell us, and I felt that, whilst chemistry helped us a good deal, it was in all probability the microscope that would ultimately reveal to us, somehow or other, the germs of disease. I was interrupted by the author of the paper under discussion with the question: "A-t-on jamais vu un germe?" I was obliged to confess that I did not think any one ever had, or recognised it as such if he had seen one.

Now, as a test of progress in the seven years that have elapsed since then, it may be asked, "would my answer be the same to-day as it was then?" The same, yes, but with a difference. It is true

that we have the Bacillus of Anthrax and the Bacillus of Tuberculosis, the connection of which with these diseases is undoubted, but it still remains to be *proved* that each is "teterrima causa morbi." On the other hand the Cholera Bacillus and some others less generally known are by no means in the same position, for much has to be done and proved before they can be invested even with the comparatively established status of the two first named. Thus my answer would have to be something like this: "We cannot positively affirm even now that a germ has been actually seen, but certain microbes have been recognised as being constant in certain forms of malady. Our methods of observation have also been vastly extended and there is every reason for hope for the future." Since that time a powerful aid has come to the microscope, in the method of cultivations of minute organisms, "Reinculturen," as the Germans, who have done so much in this direction, have called them. By these means much information has been obtained, which neither chemistry nor the microscope unaided was capable of yielding, teaching us something of the life history of those remarkable organisms and their relations to each other, as well as to the more highly organised beings upon which they seem to prey. On account of the failure of the highest powers of the microscope to detect any signs of life in liquids, which later on gave undoubted proof of containing organisms, it was surmised that spores might be present, either so minute or with refraction differing so little from the media they existed in, that it was impossible to see them. Cultivation in nutrient media, aided by improved manipulation and methods of preparation and staining, has revealed quite a new world of living things. It has also shown that in this mikrokosm there is a reign of law as there is in the communities of our makrokosm, an antagonism of races as there is among men themselves, for some organisms which grow and flourish when cultivated alone, decay and perish in the presence of others, just as one race of men or animals seems to fade before the encroachments of another.

Taking advantage of this, attempts have been made, crudely and somewhat prematurely, to play off, as it were, one microbe against another, as in the proposal to fight the Bacillus of Tubercle by regulated inhalations of Bacterium Termo, the common microbe of putrefaction. These attempts have, up to the present time, resulted in failure, and this need not surprise us, for we do not know all the question yet, and we must creep before we walk. There seeems, however, good reason to think that there is some foundation for the notion, and that the method may yield fruit hereafter. But these researches in this new branch of Bacteriology have led to still further considera-

tions, for they have shown that most of the activity of Nature is dependent on those minute organisms. This has long been known to be the case in ordinary fermentation and putrefaction, whilst the resemblance between the action of disease-poison and the process of fermentation gave rise to the term "zymotic" (from ζύμη, a ferment), as applied to diseases which seemed to proceed with a quasi-fermentative process. It was also reasoning from those more familiar cases that led Pasteur and others to the investigations which have brought out such surprising results. There seems every probability that processes which were formerly looked upon as purely chemical, such as nitrification, are brought about by bacterial agency, and indeed this has been positively proved in the case of nitrification by the exhaustive experiments of Schützenberger and Warington. But even in the case of our own bodies, it is probable that all the changes, physiological as well as pathological, are dependent upon those minute workers, so that the terms "vital action," "vital force," used by older writers, were not such misnomers, after all, even allowing that those who used them had very little notion of how the said actions or forces worked or were evolved. We must thus look upon this Bacterial or Microbial underworld not as an utter enemy, but as a mighty agency for good or evil, as the case may be: we see that we could not exist without it, nor can we in some cases continue to exist in company with all of it. Our cue would seem to be to help the friendly microbes, and to fight those that are our foes. A good general rule, but how is it to be carried out? Clearly the first thing to do is to learn to recognise friends from foes, a process that can only be the outcome of long and careful experiment, such as is now being carried out both abroad and at home, in spite of much opposition and difficulty.

But comes another crux: we know by experiment that by certain treatment a malign microbe may be converted into a benign or, at least, innocuous one; but, on the other hand, we also know that he is capable of relapsing, and further, that those ordinarily looked upon as benign may, under certain conditions, assume malignant qualities. It is therefore not enough to recognize the individual, but we must also know his habits and ways, his comings and goings, and the conditions which may alter his natural constitution for better or worse. We are also not yet sure that the recognized individual species are really completely differentiated. One form may pass into another, for all we know, or it may be a spore or larva of another form, to use expressions somewhat vague and doubtfully admissible.

Much has been said lately about the doctrine of evolution as

applied to disease, and my learned colleague, Professor Aitken, has lately published a most suggestive essay on this difficult but fascinating subject. Certain observed phenomena, which seem to point to possible hybridism in disease, have also an important bearing on the question. I do not wish to suggest that one form of disease may breed another form, now considered different, although, if we admit the possibility of certain changes in microbial development, it does not seem devoid of all possibility. On the other hand, we may rest pretty well assured of one thing, namely, that there is no such thing as spontaneous generation of disease. All attempts have failed to show a tittle of evidence that anything organised can arise from anything but a previous organism, and if organic life ever had a beginning no such fresh point of departure can be looked for in the existing dispensation. At the same time we may come from time to time upon strange and unexpected sources of disease, such as scarlet fever from the cow, as there seems strong reason to believe, since Mr. Power's elaborate inquiry. This is, however, a very different thing from a spontaneous origin,—it is merely an unexpected and hitherto unrecognised habitat of the particular pathogenic organism. We must be prepared to meet with the unexpected in this way, and it is only by such careful observation and inquiry that the weak points of our defence can be found out and strengthened.

The methods of enquiry by the cultivation of organisms, as regards drinking water at least, have not yet produced much practical result, although sufficient evidence has been obtained to show that we are likely to obtain important information in that direction. But until we can go further in the recognition and detection of different organisms, and establish their connection with particular forms of disease, we are working pretty much in the dark. In addition to the work being done in continental laboratories, I may refer to the paper by Mr. Percy Frankland, in the proceedings of the Royal Society, and to Mr. G. Bischof's paper read before the Society of Medical Officers of Health. The former is much the more sanguine paper, written by a young and rising observer, whilst the latter is from one of long and tried experience, who had hoped much from the method, but found that hope, for the present at least, somewhat disappointed. But, as they say in German, "*verschoben ist nicht aufgehoben*"; and we may hope that further experience will give us more knowledge and more confidence. It is a fortunate thing, however, that we are less dependent upon this knowledge for the carrying out of prophylactic measures than might be supposed, for, even if we possessed it, it would not materially alter at present our course of action.

It is shown that pathogenic bacteria (or what are believed to be so) propagate best under unhygienic conditions, light, fresh air, and pure water being inimical to them. It is also admitted, even by those who pooh-pooh the germ theory, or indeed any specific disease cause, that unhygienic conditions demand to be remedied, and that pure air, pure water, wholesome food, and the other conditions which make the sum of hygiene, are imperative if man or animal is to be maintained in health. The Committee at the India Office, which was assembled to consider the question of the Comma Bacillus and the report of Drs. Klein and Heneage-Gibbes, came to the conclusion that Dr. Koch had not proved the absolute connection of the Bacillus with cholera as an efficient cause, but at the same time they said that even if the contrary had been the case it would not in the meantime have altered things, in so far as to compel the authorities to make any material change of procedure in the measures taken for prevention. Quarantine of all kinds was condemned as useless, and not only useless, but as in every way pernicious. There remains for Preventive Medicine, until we have far more extended knowledge of pathology and etiology, the steady path that is being already trod in the direction of providing for the purity of all articles of food and drink, of dwellings, of clothing, of persons ; the supply of fresh air, and the immediate and complete removal of all refuse and effete matter. If to this we add a proper mode of life, both physically and morally, we may practically snap our fingers at both Bacterium and Bacillus. In the meantime, there are diseases among us which those measures seem as yet powerless to prevent, such as small-pox and hydrophobia. Under these circumstances, we should be foolish not to accept such help as vaccination, for instance, affords, although it might be difficult, even if it were considered necessary, to induce the public to be inoculated with hydrophobic matter, except under the terror produced by having been actually bitten. These measures, however, are the adjuncts of Hygiene, which aims at operations on a wider scale, by so sterilizing the soil on which the malignant microbe seeks to flourish, that he shall no longer consider suffering humanity to be his rightful heritage.

Sir Spencer Wells (London), President of the Congress, said that it was not customary to discuss the addresses of Presidents of the Sections, and called upon the Very Rev. the Dean of York to move a vote of thanks to Professor de Chaumont.

The Very Rev. the Dean of York said that in the spirit of obedience which animated all there, he was sure, he rose to move that the thanks of the meeting should be given to Professor de Chaumont for his able address. The Dean remarked that he could only speak of the address they had listened to from the standpoint which he occupied as an ecclesiastic, and he did not presume to address a body of scientific men as of equal rank with them in science. There were two things which struck him as an ecclesiastic on listening to the address, and observing how it was received. In the first place, the matters brought before them in that address appeared to him to show that the more they studied science the more what was revealed showed the infinite wisdom and illimitable power of the Great Creator, and every step they took in scientific investigation displayed the marvellous wonders of His glory. The second point was with regard to the manner in which the statements are received by the scientific mind, the way in which they are examined, and the reluctance shown to jump to conclusions before the statements are established as facts, made him wish that in his own calling there was a greater spirit of investigation of statements, and more toleration of others' views displayed, for then, he was sure, there would be far more harmony than at present existed.

Captain Douglas Galton (London) seconded the motion, and said that this most interesting address was replete with practical suggestions for the promotion of sanitary science, and it was undoubtedly the fact, as Professor de Chaumont had shown, that it was quite within our power to resist the encroachments of insanitary evils by taking sanitary precautions. This, indeed, had been shown from the earliest times, —from the time, at least, of Moses,—and compliance with the laws of health, such as the adoption of prophylactic discoveries, the removal of refuse from the midst of the population, the purification of the air, and care in the water-supply, together with leading moral lives, were necessary to protect people from the attacks of epidemic disease.

The vote was carried by acclamation, and Professor de Chaumont, in acknowledging it, said that as the Institute endeavoured to bring all classes together in these congresses, he was compelled to frame his address for a popular audience, but that it was difficult to do so without using many technical names and expressions, for which there were no equivalents in ordinary language.

On "*The Economy of Cremation*," *by* W. Eassie, C.E., F.L.S., &c.

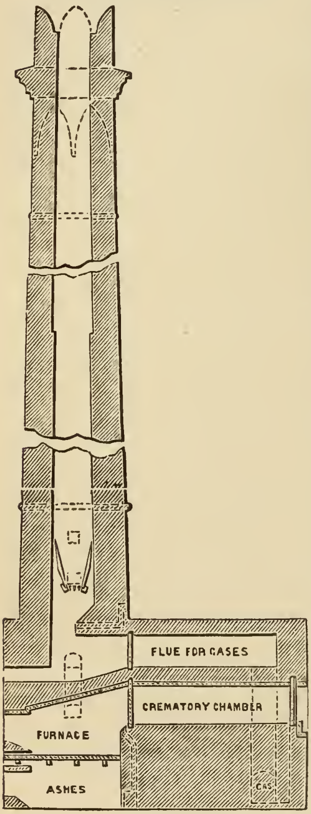
This paper, written at the desire of our esteemed President, Sir T. Spencer Wells, Bart., is not intended to set forth any of the arguments in favour of cremation as being necessary in order to obviate the evils which accrue from the pollution of air and water by overcrowded burial sites, because it may be taken for granted that the thinking community are perfectly satisfied that the crowded dead injure the living, and that if this source of danger be not removed, or, at least, abated, it will become more and more intensified until an ungovernable climax be reached. I will refer chiefly to the economical aspect of the question, and endeavour to show that cremation is preferable to Inhumation, and that, at all events, it should have, in national practice, in respect of its greater economy, a wide and extended observance. I am mindful that much has been done to reform the practice of burial in the earth by attempting to abolish imperishable coffins, and by seeking to reduce the cost of funerals, and all this with commendable intentions, but I cannot hide from myself that this reform became most active when the idea of reviving the rite of cremation was advocated, and one may admit that if the bare idea of its resuscitation has accelerated a reform in earth burial, cremation has already scored highly.

As there may be present some persons who do not understand the scientific process of modern cremations, and who might fancy it to be of a harrowing character, I exhibit the two chief systems of cremation extant in our time, viz., the "Gorini" system of reducing the body to harmless ashes, as practised throughout Italy, and in Paris a crematory on this system is now being erected, and the "Siemens'" system, mostly approved by the German people.

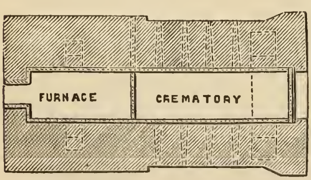
The Gorini system is here shown by a plan and section of the crematory belonging to the Cremation Society of England, and erected at St. John's, Woking, Surrey. The procedure may be shortly stated to be as follows: A fire is first lighted in the chimney close to its base, and through this all smoke and evolved gases are destroyed, thus precluding the escape of any deleterious products which may have escaped from the first combustion in the crematory chamber. A fire is then lighted in the furnace portion of the crematory, and this

is chiefly composed of wood faggots, with a sprinkling of anthracite coals, and the heat from this passes through flues under and above the crematory chamber where the body is placed.

THE GORINI SYSTEM.



LONGITUDINAL SECTION OF THE WOKING CREMATORY.



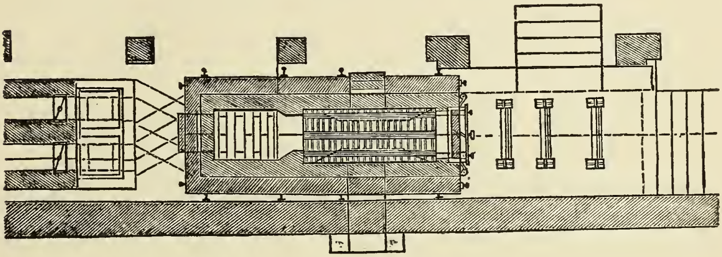
PLAN OF THE WOKING CREMATORY.

When the reception chamber has been sufficiently heated the body is introduced, and is consumed in little over an hour, the residuum being pure white ashes, such as are shewn in the glass vase before me, which represent the result from the destruction in the Woking Crematory of the largest bones of a horse. The tray is withdrawn after the chamber has somewhat cooled down, and the ashes reverently deposited in a suitable receptacle. On the Siemens' system, which is also represented, the requisite amount of destructive heat is first of all generated by combusted fuel, the flame from which imparts most of its heat to the fire-brick, or regenerator, chamber, shewn to the left of the drawing, and when the apparatus has been in operation sufficiently long, this fire-brick and crematory chamber become of the usual white heat. The tray containing the body is then slid along the rollers, shewn on the right of the plan, into the crematory chamber, atmospheric air is laid on, and when the ashes have fallen into the receptacle below, they are inurned.

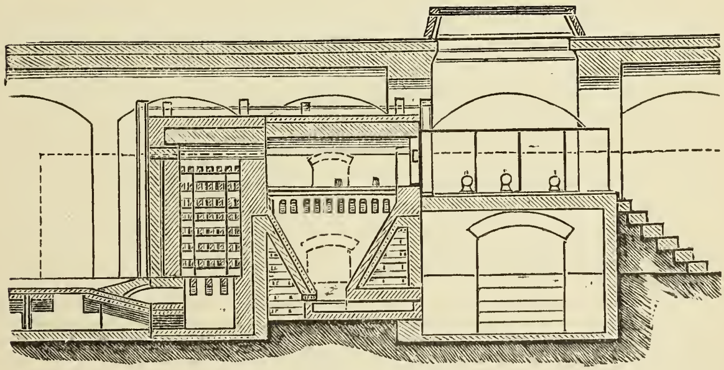
In both processes cremation is conducted without the body being exposed, and it is carried out in such a manner as to disarm sentimental objection. I may here mention that, after witnessing the second cremation at the Society's Woking Crematory, the relative present was so satisfied of the grand conception of cremation, as opposed to that of lingering putrescence, that he became a life member of the Society on the following day, and desired cremation for his own remains. I

may say, also, that at the sixth cremation the husband of the deceased expressed his regret that his daughter was not present, from both of which instances you may infer that cremation has been foully slandered in many quarters.

THE SIEMENS' SYSTEM.



PLAN.



VERTICAL SECTION.

Of the two systems of cremation, the cost of building a crematory upon the Gorini system would be about three-fourths cheaper than one built upon the Siemens' system. The Gorini system is also more suited for country places, because it will burn the poorest wood fuel. Both crematories will destroy bodies when they have been deposited in the thickest oak coffins; but this practice is reprehensible on account of unnecessary expenditure, as the remains, if not consumed in an approved shroud, should be placed in the thinnest shell of ordinary wood. I think that here, perhaps, could best be made serviceable the use of wicker baskets. I give the above information incidentally because, before any comparison can be made between two things, some knowledge of both is necessary.

Statistics are sometimes very misleading, but those referring

to burial may be taken as reliable, because they are mostly due to the labours of Mr. Edwin Chadwick, C.B., our veteran sanitarian, and vice-president of this Institute, Mulhall and others ; and I may have occasion to apply some of their figures during the reading of this paper. First of all, as to the question of land. Taking the population of England and Wales at 27 millions, the number of now existing cemeteries for this population is about 11,400 for England, or at the rate of 45 for every 100,000 persons, and about 960 for Wales, or 71 for every 100,000 persons.

It is now usual to allow a quarter of an acre to each 1000 head of population where the soil is favourable, but this figure must be greatly enlarged where much embellishment of the ground is desired. I need not go into the statistics published in 1843, when it was discovered that the graveyards in London were sometimes forced to accommodate 1200 bodies, and sometimes as many as 2300 per acre, but I may state that at present London has 22 cemeteries with an aggregate of 2210 acres. For decennially renewed interments Whitechapel alone would require seven acres of cemetery accommodation for every 20,000 inhabitants. London will therefore appear to be at present well provided with cemeteries, if these were accessible to the population of each district. But the contrary is the case, and hence additional cemeteries are in process of projection for various districts where the existing ones are held as being too remote from some centres of the population. London must be taken as an exception when speaking of the necessity for extra cemetery space, because its population is dense and intermural interments are now forbidden. In the country the death-rate is different, and assuming the deaths for every 35,000 in the metropolis to be 1200 yearly, the deaths in a rural place like Hereford might be counted at about half of this figure. Thus, if Whitechapel would require over 7·4 acres of burial accommodation for every 20,000 inhabitants, Hereford would require 4·3 acres for the same number of persons.

We may safely assume that in a few years time the ground appropriated to the dead for the Metropolis alone will reach 3000 acres. The Metropolis has at present one acre of burial ground for every 1,700 inhabitants, which is much in excess of the quarter acre for every 1000 inhabitants recommended by the authorities. This recommendation, however, is sometimes doubled by various cemetery authorities in order to provide for the planting of suitable shrubs, and the laying out of ample roads. At the rate of one acre for every 4000 inhabitants, 6,750 acres would be required to accommodate the 27 millions of residents in England and Wales ; and the more our cemeteries

are extended for embellishment, and the more their grounds are allowed a suitable rest by providing extended sites, the more these figures would be enhanced. The whole of this land is alienated, looking at it from an agricultural or mining point of view, and the misappropriation will go on increasing.

Our burial laws specify that each adult shall be entitled to four superficial yards of earth, and, accordingly, after allowing for the predominant death rate among children, this figure gives an average of 27 superficial feet. Taking the recommended depth of each grave to be 10 feet, this would show that 10 cubic yards of earth space are in process of allotment for each person. The average cost per acre for the land purchased for cemeteries was reported to the House of Commons in 1851 as being £123 per acre. This would be a fairly computed cost per acre outside the Metropolis, but the cost of land around London would be in excess of this. Taking, however, this low estimate, the cost of the cemeteries connected with the Metropolis would be nearly £272,000.

Were cremation practised by 50 per cent. of the population of the Metropolis, a piece of ground not larger than the Woking cemetery, or about 500 acres, would be sufficient ground to allot for their wants, and at the same average rate of purchase, this ground could have been bought freehold for £62,000, which would have been a saving of £75,000, and 605 acres would have been spared from pollution. To the calculation of 500 acres as being sufficient for the wants of the Metropolis and suburbs, if half of the population of say five millions practised cremation, it will be seen that an acre has been reserved for every 5000 persons; and considering that an urn would not require more accommodation than one cubic foot, it is easy to perceive that one-fourth of these 500 acres would be sufficient upon which to erect crematory temples and columnbaria resembling those at Milan and Gotha, leaving 375 acres for roads and gardens.

This space of 125 acres would serve to accommodate the wants of a population of $2\frac{1}{2}$ millions for more than 1000 years, even after according permanent space for each urn. But it is proved that a great number of persons have arranged for their ashes to be simply strewn over the ground; and as any custody of the ashes could not really be permanent—in Gotha the care of the urns are only for 20 years free—the urn spaces will in some cases be transferable. As for the cost of the erection of the chapels, crematories, and columnbaria, this would be more than met by the cessation of the expense for buildings and maintenance now spent upon the 605 acres of ground which would be saved to the metropolis. As it would be with London, so

would it be throughout the country in a proper ratio, were only a moiety of the people to practise the reformed rite.

The expenses attending the total number of funerals in England and Wales in 1884 was given by statistical returns as amounting to £4,871,000, and it was reported that half of this could be saved if national cemeteries were erected by the Government. This saving was mainly to be achieved by the reduction of the expenses of undertakers. The average cost of each funeral, as given in Mr. Chadwick's tables for England, was 13s. for paupers, £5 for the working classes, £40 for the middle classes, £100 for the gentry, and £1000 for the nobility. This would be an average of £10 for each interment and make up the sum of five millions sterling just quoted. It was computed that in the metropolitan area a death takes place every ten minutes, correctly reckoning 114 funerals per day (which, however, might reach 500 a day during an epidemic); the usual attendance of some 2000 mourners can be reckoned upon. When these statistics were called for by Parliament there were some 730 tradesmen waiting for these deaths, which do not include those of paupers, and for providing the funeral. There were thus some 600 firms of undertakers, upholsterers, carpenters, builders, &c., biding their time for a chance of a lucrative interment in the metropolis alone.

The steadfast war now declared by some members of the upper circles against useless expenditure in funeral expenses, lead coffins, polished shells, with grand fittings, hearse fittings, feathers, heralds, ushers, and porters, is most hopeful for the interests of cremation, as laying the basis for a thorough reconsideration of the present method of the disposal of the dead. The sorrow of relatives who can afford the expenditure will possibly always be demonstrated by the hearse and pall, but between this decorum and useless expenditure a very broad line must be drawn.

Tombs are either allotted for perpetuity or for a number of years, or for single interments, and there are also pauper graves. In the first-mentioned category expensive ornamental tombstones are usually needful, and when the vault or grave is reopened this is a great corresponding expense.

If cremation were practised this would be saved to the family as all that would be required would be the removal of the slab in front of the chosen niche in the columnbarium, which niche could be purchased at one-tenth the cost of a grave. If cremation were to replace inhumation, a safe calculation shows that the cost (including removal to a near crematory) might be safely computed thus:—For paupers, 10s.; for the working classes, £2; for the middle classes, £10; for the gentry, £50; and for the

nobility, £100, that is, provided there was no ostentatious display. The cost of cremation for fuel expended for the Gorini apparatus may be reckoned at about 7s. for each cremation, and as some ten cremations could take place daily in a single crematory, the attendance being reckoned at 10s. per diem, and the allowance for use and repair to the crematory and maintenance being computed at 2s. 6d. per diem, it is reckoned that in 310 working days in the year the cost of the actual cremation of the 3,100 dead might be performed for about 10s. 6d. each.

In reckoning the allowance for each funeral from 10s. for a pauper up to £100 for the highest classes, I have taken into consideration average cost of proper conveyance to the nearest cemetery, minister's fees, and the like.

At present there can be no realization of the above desirable state of things, as never more than one cremation has taken place in a day, and I have been calculating at ten per diem. The cost of cremation is consequently greatly enhanced.

I have endeavoured to prove, and I believe I have succeeded, that burial in the earth is a waste of land and of money, and that it should long ago have been largely replaced by cremation; and to bring about this desirable end, every cemetery should be compelled by law to provide a crematory within its precincts, with suitable accommodation for the ashes whether inurned or buried. This idea is held to be necessary by all who have studied the welfare of their kind and the good of the commonwealth. The depurating power of the earth has been overrated, and the lesson read to the nation by Sir Henry Thompson must be perpetually repeated. It has been a great pleasure to me to read this paper in accordance with the wishes of the President of our Congress.

[*For discussion on this paper see page* 86.]

On "Improved Method of Interment," by W. Robinson, F.L.S.

A few weeks ago a ghastly story came to us from Paris of graves being robbed of their dead by one whose duty it was to take care of them. The fact is only named here because it is typical of so much in our burial custom, which carries decency to the verge of the grave and then leaves the poor body to pollution always, and indignity often. It is typical of the

reeking graveyards of Europe, from which nothing but ugliness, horror and danger can come. We pretend to respect the dead, and erect costly tablets to perpetuate their memory in graveyards, the contents of which in cities are often carted away as rubbish after a few generations have passed. With a proper system of burial disrespect to the ashes of the dead or danger to the living is impossible. In visiting in various countries, the cemeteries of large cities often spoken of as beautiful, I saw so many gruesome sights that the conviction was forced upon me that there is but one way out of the burial difficulty!

Many of the evils and difficulties with which we have to contend puzzle the wisest, but with urn-burial the way is so clear, and the gain all round so great, that nothing but custom and thoughtless prejudice can prevent a wholesome revolution in all that concerns the disposal of the dead.

The drawbacks to our burial-system would disappear when any inoffensive and prompt system of reducing the body to ashes were adopted; there will be no need to close even the city cemetery at any time, and urn-burial could be carried on for hundreds of years in a cemetery no larger than any of the present over-crowded London ones, without the slightest offence to the living. The space set apart for urn-burials need not be more than a fourth of the area of a large cemetery, and thus at the central or main part there would be ample space for gardens and trees. A cemetery for urn-burial must not only be a garden, in the best sense of the word, but the most beautiful and the best cared for of all gardens. The present mode of using the ground often leaves no room for either garden or planting, owing to the dismal regiments of stones that cover the soil. It is impossible to overrate the opportunities for improvement in beauty and art that would be secured by the continuous existence and use of a cemetery.

A permanent resting-place for the ashes of the dead is not possible under our present system: with urn-burial the simplest stone inscription may be in as good order a thousand years hence as to-day. The city graveyard being now only of temporary use, such monuments as it possesses share the fate of all the other materials when it is closed; and the frequent disturbance of the ground for interments is against any good work in such art as the place invites. Actually in Paris the foundations of roads are made of headstones only erected a few years ago, and though in London memorial stones to "perpetuate" the memory of individuals are not cleared away so promptly, the result, in the end, is very much the same. Pieces of broken tombstones, some of them bearing dates, were among the débris which

a contractor "shot" into Kensington Gardens a few years ago!

The adoption of urn-burial would at once place all that relates to the artistic embellishment of a cemetery on a very different footing. A cemetery which is now filled up in the space of an ordinary life would, on an improved system, provide accommodation for many ages. Neglect and desecration of the resting place of the dead would give place to an unremitting and loving care, for each generation would be as much interested in the preservation of the cemetery as were those that had gone before at any time in its history. With the establishment of a permanent resting place for the dead would come the certainty that any memorials erected to their memory would be preserved.

In old Roman cemeteries beautiful tombs may yet be seen, with the urns within them, in as good order as when placed there two thousand years ago. A single tomb, in such cases, served as a family burial place: the money now spent upon a variety of graves and headstones, and in the purchase of ground, would suffice to build a tomb that might endure for ages.

Urn-burial would give us everything we can desire for artistic taste: soft green, undisturbed lawns, stately and beautiful trees in many forms, ground undisturbed in the way of quiet beauty, a background of surrounding trees — no hideous vistas of crowded stones.

Urn-burial could be carried out to any extent in churches and city graveyards. For various reasons, many persons would prefer burial in churches or near them, but, as is well known, the evils of the present system of burial became so horrible and so evidently dangerous, in the case of city churchyards, that burial in cities was forbidden by law—and not too soon. But the evils from which we were then saved are again appearing in populous suburban districts, and soon the numerous family tombs and graves in our extensive suburban cemeteries must fall into disuse. Establish urn-burial, and people who have family tombs in neglected city churchyards would take a renewed interest in them—an interest that might save them from desecration. Our churches and even our cities would be more interesting, for there is a certain fitness in men resting in death near the scene of their life and labours. The ashes of those who had deserved well of their country might be brought home from any distant place, where they had perished, and receive a place of honour in our national churches and buildings. Vaults, passages, niches and walls in churches would form suitable places for urns and their inscriptions.

Though I have in these few words spoken only of the great advantages which urn-burial would give the gardener and the artist, one aspect of the question from a purely sanitary point of view deserves a word. It is on the utter futility of the earth-to-earth or coffinless burial as a remedy for the great and what will soon be the intolerable evils of our burial system. Coffinless burial in no way frees us from polluting earth, air, and water! This is easily proved by burying even a small animal and turning up the soil a year afterwards!

There is not, and there never can be, any satisfactory way of disposing of the dead, which does not do, promptly and inoffensively, what is now done in the slowest and most odious manner. Until some better system is devised, cremation is the only method which will rapidly resolve the body into its harmless elements by a process which cannot offend the living, and which will render the remains of the dead innocuous. This system is also that which gives us the amplest opportunity for making a cemetery a blessing instead of a danger to its neighbourhood; by its means we may have memorials preserved from decay; ground from sacrilege; soil and water from impurity; art not unworthy of its aim; church burial for all who desire it; space for gardens and groves in our cemeteries; the mindfulness and care of each successive generation; deliverance from the undertaker, and his "effects"; many precious open spaces in cities, free from dread or danger; age-enduring cemeteries, in which efforts towards "perpetuation" of the memory of the dead need not be so delusory as they now are; quiet places where the ashes of the dead should never be dishonoured, but might find unpolluted rest.

[*This discussion applies to the two preceding papers by* Mr. W. Eassie *and* Mr. W. Robinson.]

Sir Spencer Wells, Bart. (London), remarking that his views were well known, said that there were some points he could add for the notice of those who lived in such large ecclesiastical centres as York. If cremation were adopted such places as the glorious Minster of York could still be used for the perpetuation of the memories of the dead who had lived worthily in the estimation of their generation, and such dead would not poison the living, as was now the case in the present burial system. The dead, by the occupation of useful land for burial places, were crowding out the living, and injuring the living by polluting the air and water. If the dead were subjected to

fire, and the remains converted at once into innocuous elements, they could be reverently preserved in the great temples of worship, without being a danger to the living as at present. No religious doctrine was affected, and public sentiment, when educated, would prefer a purifying to a putrifying process.

H. E. SPENCER (York) remarked that he had given much time and attention to the subject, and a pamphlet had been compiled by a local body with which he was connected. A study of the facts had led him to the opinion that the arguments in favour of cremation were unanswerable, for the benefits it conferred were unquestionable, while, on the other hand, the arguments against it were scarcely worth discussing. He asked the medical members of the Congress to say "Yes" or "No" in regard to cremation; but those who said "No" would have to give reasons for their views. For his own part he could not understand why cremation was opposed by any class in the community.

The Rev. F. LAWRENCE (York), (Secretary of the Church of England Funeral and Mourning Reform Association) addressed the Congress on behalf of the objects of that Association, and in support of burial in perishable coffins, on the so-called "earth-to-earth" system in preference to cremation. The arguments in favour of cremation, he submitted, took their rise not from burial itself, but in the abuse which had arisen in the mode of burial. He contended that by a judgment of Lord Stowell, heavy coffins could not be used, and by the rubrics of the Prayer Book "the corpse" must be met in burial by the clergy. He insisted that all sanitary requirements were met by the use for each corpse of a perishable coffin, and the separate grave, which could be used again and again for all time. He appealed to the members of that Institute to help on the work of the Association, as one of a scientific character.

Mr. NORTH (Medical Officer of Health of York) said that, with all the respect he had for his friend the last speaker, he had for himself still to learn what were the elements of public health in the proposals of the Funeral Reform Association. Mr. Eassie, or any practical man, for that matter, could say what would be the condition of land in which one grave was used generation after generation for burial. The revelations of the sexton, under the present system, were horrible; but under such a system as that propounded by the Funeral Reform Association, he feared there would be an increase of the evils. As a Health Officer he protested against the practice of carrying the body into places of worship among the living while a religious ceremony was performed. It was time the question of the disposal of the dead was dealt with, for by the growth of the population the towns were overtaking the country, and thus the cemeteries were becoming parts of the towns. It must be remembered that the dead must always be more numerous than the living, and if the method was continued of preserving

the dead, there would in time be no place for the living. There was talk about "respect for the dead," but when it became necessary to widen streets in places where the dead were buried, to drive a railway through any place where there was a cemetery, or to do any other public work, where was the regard for the dead? Was there any regard for the sacred places of burial then? No, the sacred character of the dead had to give way to the necessities of the living, and it was certainly time, in the interests of the public health and of respect to the dead, that the public woke up to the necessity of removing all decaying matter from the midst of our populations. We could rightly only look upon our dead friends as so much decaying matter, and the more we hold these dead friends in honour the more were we sinning against decency and respect for them, and against sanitary science in keeping their decaying bodies amongst us to create disease, and to associate them in our minds with that decay which was shocking to contemplate. He knew no way out of these evils except the purification by fire. If people had seen bodies as he had seen them, they would have said "Burn them: do not let the children of these dead parents see under these shocking conditions those whom they loved." He was convinced that if the two methods of disposing of the dead—by burial and by cremation—could be seen side by side, and considered by the population in all aspects—the light of respect to the dead, of decency to the dead bodies, of the duty to the living: alike on the score of sentiment as well as of sanitary science, cremation would commend itself to others' as it did to his judgment.

Mr. Wynter Blyth (London) did not oppose cremation, which he thought should be tolerated only—that was to say that all those who desired to be cremated, or to have their friends cremated, should be allowed to have their desires carried out; but he was opposed to Mr. Eassie's views that the cemeteries should be compelled each to provide a crematorium. It was unquestionable that reform was needed in the present system of burial, from the points of view which had been stated. He thought it would be a sufficient reform if one body were buried in one grave, that no tombstone should be allowed, and that in say twenty-five years the ground should be allowed to revert to secular uses. By such a system all the advantages which could be derived from cremation would be given, and this without trenching upon the sentiment created by long custom. Looked at from some points of view, cremation would certainly be the best method to adopt; but then there was the sentiment of the population, and the question of safety in regard to crime. After all, the evils which were making themselves felt in respect to the present system were the outcome of an abuse of the churchyard burial; but he could not say the Church Burial Reform Association's method would correct all the evils which were presented, and he referred his hearers, for details of his own views, to published statements of those views; but he would add, that his opinion was that what was needed was a reform and not a revolution. Much was said about "the decomposing

matter" of the human body: but then the earth was full of "decomposing matter," and he held that so long as the body was put at a proper depth its decomposition would not matter. He appealed to those who walked through cemeteries to say if the evils of the present system as now carried out were of any magnitude. The question would also come before them as to the quantity of land which was to be taken for burial purposes—and that was really the serious question. If it was to be declared that a piece of land once taken for the disposal of the dead was never afterwards to be used by the living for secular purposes, it would be a most serious thing, but as a matter of fact, lands once consecrated to the dead, were constantly reverting to secular uses. Some bishops held strong views against this, and it was difficult to get this reversion to secular uses in certain dioceses of lands once consecrated to the use of the dead; but he hoped that the church would look upon the future reversion of such lands in a more reasonable light than hitherto, and not attempt to withhold land from the living for ever because it had been in use for burials.

Mr. Washington Lyon (member of the Corporation of the City of London) considered that it would be long before the nation would adopt, for the disposal of the dead, this system of cremation; but he presented a system of cremation of his own, a system, he said, which could be carried out without interference with the present system of burial. He presented to the chairman's notice a mouse he had cremated under his system, and this mouse, he said, was cremated fifty feet from the fire, by a system which burnt out the noxious gases, and left the body in its usual appearance. This system (particulars of which he did not make public) would meet, he held, all views—those of sentiment, and those who advocated cremation on sanitary grounds.

Surgeon-Major Pringle (London) described the systems of burial and cremation he had seen in various parts of India, and he pointed out that the burial of bodies in some parts of that country would ultimately seriously affect the water-supply of the population. He said he had been shocked to see the unceremonious manner in which bodies were treated in this country, when they were in cemeteries which stood in the way a railway was intended to pass, when he knew of cases in India where the Grand Trunk Road was diverted to leave untouched the tomb of a Mahomedan saint, so that the upholding in this country the present system of burial on the score of respect for the dead had no footing, seeing that respect for the dead was not allowed to interfere with the necessities of trade and commerce. If cremation had not been carried out in India at places subject to annual fatal epidemics, the locality would have been uninhabitable.

Mr. Baldwin Latham, M.Inst.C.E. (London), called attention to the unsuitable character of some soils for use as burial grounds,

and gave his experience of a churchyard on a clay soil, where the heat of summer made so many fissures in the ground that the place had to be kept sweet by the use of disinfectants, and he spoke of the evils of burial on porous soils by the percolation of the decaying matter into the sources of water-supply. Dealing with the Rev. Mr. Lawrence's exposition of the principles of the Burial Reform by adopting a system by which the bodies would decompose more rapidly than by the present system, he said he could not understand what advantage would arise to the community by this method, and indeed he, for one, could give practical examples against the proposal. He explained, by means of the blackboard, the carrying out of some works at Merton, Surrey, near the river Wandle, and adjoining the Lambeth parish cemetery. While there engaged in cutting a sewer, not far from a spot where paupers were buried in thin coffins of a like character to the "earth-to-earth" ones, the work of the men was interrupted by a black putrid stream which ran from these graves. Every one of the men engaged there was afterwards taken ill, the cause being the evil effects of the putrid ichor from dead bodies exposed to rapid decomposition; and such would be the result of the system proposed by the Burial Reform Association. It was impossible to conceive how the present system of burial would be improved by merely hastening the decomposition of the bodies committed to the grave. On the question of the water-supply being affected by the present system of burials, he said it was to him a matter of regret to see new cemeteries planted at places where they would affect the watersheds which gave supplies to large populations, and he could say that if the people did not suffer from this action now, they would in the immediate future. One objection made to cremation was that it was apparently new; but this was not so, for it was an exceedingly old system, and unless measures were quickly taken to revert to this or some other system of dealing with the dead in a manner which would have regard to the feelings of the living, the dead would overcome the living. The Congress should thank Mr. Eassie for his thoughtful paper, and for the trouble he had taken in showing the economic side of the subject. As to the present system of burial being detrimental to the living from an economic point of view, cremation was greatly to be preferred. There were other points of view, and one which came before his own mind at that moment was, that the living could respect the ashes of the dead when presented in an innoxious form. He had, some time since, to stand by an open grave in which, some months previously, a member of his family had been interred, and the effect was very unpleasant. How could it be said that one could have respect for dead bodies under such conditions? He could not understand how there could be any respect for remains which created repugnance to the senses. When remains were cremated there was no such sense of repugnance, and he earnestly hoped that the drift of public opinion would be in favour of the plan best suited to our necessities, to decency, and to respect.

Dr. Ewart (Brighton) recognised the absolute value of cremation,

and would give it a fair field, but no favour. The exception he would make was that he would return the ashes to the soil. He thought Nature intended it. It was necessary to give back to the earth that which had been received from it in respect to mineral matters contained in the ashes.

Dr. Tempest-Anderson (York) urged that if they cremated the dead, they must, to be consistent, say that other organic refuse must be treated in the same way; that their sewage should be similarly treated, because it was organic matter of a decomposing nature, and was equally as dangerous as the small quantity of organic matter that remained after they departed this life.

Dr. A. Hill (Birmingham) remarked that Mr. Eassie's paper had brought up, in the discussion, some few of the old type of objections which were of the weakest possible character. Dr. Ewart, for instance, had stated that the saving of the ashes of the cremated bodies would rob the earth of the matters which should go to fertilize the soil, and the same speaker seemed to think that the burial of bodies under the present system added to the fertility of the earth. It might have been supposed that Dr. Ewart would have known that the surface of the earth was never fertilized by the ashes of the bodies which were buried deeply in the ground, and that vegetation was never thus benefited, so that the argument in favour of earth burial, derived from the supposition that the decaying matter formed manure, fell at once to the ground. Then as to the waste of ashes stored in urns being a withdrawal of mineral matters necessary to the soil, Dr. Ewart was equally at fault, for we have in the bowels of the earth vast stores of phosphatic minerals ready to be used in agriculture, without waiting for the ashes of the dead. The speaker could corroborate Mr. Baldwin Latham as to the fearful character of the matter which flowed in blackened streams from graveyards into water courses, poisoning the air and all who came into contact with it, and it was simply absurd for any person to talk about the "purifying power" of the earth in connection with the earth system of burial. Those who talked about this purifying power of the earth ought to be acquainted with the elementary fact that the oxygenising of the dead body, and the reduction of it into elements of a fertilizing character could only go on near the surface; but that when the body was buried deeply in the earth the fertilizing qualities had no effect upon the earth. Then another class of objectors, or very often the same, talked about the "sentiment" of the people, as if the "sentiment" was to weigh against the health and well-being of the whole nation, especially when that "sentiment" was founded upon prejudice and ignorance. Instead of bowing to this prejudice and ignorance, as some seemed to imply should be done in this matter, an endeavour should be made to educate people up to better sentiments, and sentiments more in accordance with the benefit of the nation. Appeals should be made to them to bring their sentiments into conformity with the means of disposing of the dead which would be beneficial to the

living. It would be a sentiment of a right character if it were in accordance with principles of right to mankind and the necessities of the living; but if people would not do that which was in accord with the public health they could not expect to have their sentiments respected. What struck him as peculiar, after listening to the speeches of Dr. Anderson and Dr. Ewart, was that gentlemen should seize and repeat the one or two things which could be said against a proposal such as cremation, and overlook the ninety-nine points in its favour. It was said by Dr. Anderson: "What is to be done with other decaying matter, the refuse of our large towns? Why should that not be cremated?" Well, as a matter of fact, that was what was being done with much of that refuse which could not be advantageously used in other ways, and Dr. Anderson might see "Destructors" at work cremating this refuse, and rendering it harmless to the public health, as the crematorium would render the dead bodies harmless to injure and disgust the living. Another asked, "What should be done with the sewage"? But he forgot that this was not allowed to decompose in a mass in the midst of populations in the same way as the dead bodies were allowed to decompose in the churchyards; and that the sewage matter, where used upon the land, fertilized the soil. The facts shown by investigation should convince the minority who had spoken against cremation, that they were wrong in their views, and that they were in opposition to what was approved by common sense and by science.

Mr. Whitaker (Southampton) brought before the meeting the fact that cremation by lime had been applied in the case of criminals buried at Newgate prison, and contended that a false sentiment had been too long allowed to rule the public mind in this matter.

The Dean of York said that the clergy wanted scientific men to make up their minds about the question of the disposal of the dead. Incidentally he mentioned that at Easingwold, near York, there was a parish coffin, which had been in existence for several hundreds of years, whereby bodies were conveyed to the grave, and there consigned without enclosure to the earth. The question of sentiment ought to be regarded on any subject, especially on such an one as the burial of the dead. He believed, however, that the English people were highly gifted with common sense, and if they could be convinced that the exigencies of the time did demand an alteration in the system of disposing of the dead, they would not be slow to adopt an improved mode.

Mr. W. Eassie (London), in reply, remarked that the great majority of the speeches required no answer from him. He reminded them that he dealt with the economic side of cremation, and upon that matter little had previously been said. It had been urged that it would be an economic loss to the earth if the ashes were inurned. It had been pointed out that the minerals in the ashes of the dead at present buried did not come to the surface of the earth, and that,

therefore, by inurning, there would be no loss of mineral matter which the earth now received. The objection was raised on the supposition that all ashes were inurned, when, as a matter of fact, some adherents of Cremation had desired that their ashes should be spread upon the earth, and not inurned. He added that the Society published, from time to time, papers upon the subject of cremation, and that these could be obtained by the public.

On "Milk and Disease," by LOUIS PARKES, M.D., Pub. Health Cert. London University.

OF all foods derived from an animal source, cows' milk brings us into the closest relations with the animal supplying the food. Milk is very generally consumed uncooked, *i.e.*, unboiled, whilst every kind of meat is subjected to cooking by heat before being consumed—cooking being considered necessary not only to improve the nutritive qualities of the meat, but to preserve it from, and to destroy, if present, putrefactive or other injurious organisms. Milk, as being derived from the living animal, must be also to a great extent a reflection of the animal's state of health. But we may go further than this, and say that milk is, for a certain period, derived from an animal in the puerperal condition consequent on parturition—a condition known to be liable to certain disorders, chiefly inflammatory, and particularly prone to take the infection of contagious disease. Again, we know that milk has a remarkable power of absorbing gases and vapors, organic and inorganic, and is besides a fluid which possesses all the properties necessary to constitute it a suitable cultivating medium for low forms of life, fungoid or bacterial. So that it is not too much to assume that specific disease germs which have gained access to milk, may so grow and multiply in this fluid as greatly to increase its powers of infection with the lapse of time. From such considerations as these, we perceive that if cows' milk is a perfect food, containing, in the right proportions, all the dietary constituents necessary for healthy growth and nutrition in the young, yet its use—in an uncooked state—is attended with very serious possible dangers, derived partly, may be, from the animal source of supply, and partly from causes which may operate on it between its origin from the cow and its consumption by the individual.

The greatest consumers of cows' milk are young children,

and, I might add, infants, for hand-feeding amongst all classes has enormously increased, and from various causes seems likely to go on increasing. The use of cows' milk amongst adults is also increasing, but it is to children that we must principally look for evidence of disease caused by milk, as they are by far the largest consumers of it in an uncooked state, and their susceptibility to all kinds of infection is so much greater.

In this paper I propose to confine my remarks principally to one aspect of the question—an aspect which is now receiving the attention its importance deserves, viz.: the transmission of disease of the cow through its milk secretion to human beings, and to summarize briefly our knowledge of the facts and the inferences to be drawn from them in this connection.

Of causes operating on cows' milk to impart to it an infectious quality after being drawn from the cow, we already know a good deal from numerous recorded cases of milk epidemics of enteric fever and scarlatina, and a few of diphtheria, commencing with an epidemic of enteric fever due to infected milk, in Islington, 1870, which was investigated by Dr. Ballard. In 1881 Mr. Ernest Hart, in a paper read before the International Medical Congress, gave tables with particulars of 50 epidemics of enteric fever, 15 of scarlet fever, and 6 of diphtheria—4800 cases of infectious disease in all—which had been traced to an infective or a supposed infective quality of the milk supplies, and since that date there have been numerous other milk epidemics recorded. The importance of sparing no pains in extending our knowledge of the ways in which milk comes to be such a potent agent of disease is at once evident on scanning these figures.

Enteric Fever.—In the case of this disease, the most usual means by which the milk obtains its specifically infectious quality, is the washing of the milk-cans with water polluted by typhoid dejecta. This phrase, "washing the milk-cans," has no doubt included some cases where such polluted water has been surreptitiously added to milk which had been creamed, in order to restore to it its proper specific gravity, or merely to dilute a rich milk in the ordinary way of business. Wells, ponds, or ditches which drain privies or cesspools, are the usual source of such water; and it is a fact that such water, liable at any time to contamination, is still used in many farms and dairies. In other cases, where the water has been absolved from suspicion, the milk has been kept in rooms or dairies the air of which was poisoned by emanations from a drain or sewer, presumably containing the specific poison of the fever, or the person who milked the cows was himself in active attendance on members of his family suffering from the disease. The readiness with which milk will absorb foul gases has been already alluded to.

In almost all the recorded epidemics of enteric fever due to milk, such have been the means by which the milk obtained its infectious quality, and such no doubt will they continue to be found in the future. A most remarkable simultaneous outbreak of enteric fever in St. Albans and London in June and July, 1884, amongst the customers of a particular farm at St. Albans, was investigated by Mr. Shirley Murphy,* and here there was complete absence of any evidence that the milk had become infected in any of the commonly believed ways. But this case may probably be regarded as one of the exceptions that prove the rule. As far as our English experience goes, enteric fever is not a disease which can be communicated to cattle; but in Germany it is stated by Walder that he has examined calves dead of a disease bearing a very strong resemblance to enteric fever, if not actually identical; and a sudden and severe epidemic of this disease at Kloten† was attributed to the consumption of veal from a diseased calf. Those who know how veal is eaten in Germany, in a semi-raw state, will not be surprised at indisposition or serious illness following the consumption of diseased meat; but it seems doubtful whether the disease was in every case true enteric fever. Further researches on this subject, as on the whole question of the transmissibility of bovine disease, are highly desirable. The poison of enteric fever is contained in the alvine discharges, and we know how very readily the milk may become mixed with such discharges by a careless operator.

Scarlet Fever.—In those epidemics of scarlet fever which have been traced to milk, it has been usual to find that the milk was infected in the ordinary way by a previous case of the disease at the farm or dairy, or there has at least been so strong a suspicion of a pre-existent case as to amount to a moral certainty. It is perhaps hardly necessary to point out that the ordinary method of infection is the milking of a cow by a person who is attending on a scarlet fever patient, or who has the disease amongst his family, or is himself suffering from it, probably in a mild or disguised form ; occasionally the milk appears to derive its infective quality from being placed in a room or dairy in which clothes or refuse matters from the sick room are lying. It does not follow that because such methods of infection have been provided against in orders of the Privy Council that they do not occur. Inspection of dairies competent to prevent such gross carelessness, has up to now been almost non-existent. But besides such easily understood methods of infection of milk, it would now seem certain that cows are liable to a disease

* Report of the Medical Officer of the Local Government Board, 1884.
† Berliner Klinische Wochenschrift, 1878, 39, 40.

identical with or very closely resembling human scarlatina, and that the milk from animals so suffering has been the cause of epidemic outbursts of scarlatina amongst those who consumed it. The first of such evidence is forthcoming in a Report by Mr. Power,* on an outbreak of scarlatina in parts of St. Pancras, Marylebone, and Peckham, at the commencement of 1882, which was traced to the milk supplied by a farm at Farnham, Surrey. Mr. Power satisfied himself that it was "practically out of the question that the milk at the farm had become infected in any of the commonly believed ways that require a human subject as the source of infection," and he came to see that "a hypothesis of cow-causation would fit the facts that needed explanation as well as, or even better than, any other hypothesis." The only facts, however, which came to light were, that about a week before the outbreak of scarlatina in London, a cow which had calved three or four days previously, came into milking for business purposes. Nothing could be learnt as to the state of health of this cow at that time, but some time subsequently it was found that she had "here and there lost portions of her coat, and that her buttocks and posterior udder were fouled and stained by excremental matter and perhaps by vaginal discharge as well. In this respect she presented a rather strong contrast to most of the other cows." The other case, which has recently attracted a large amount of public attention, was an epidemic of scarlatina in December 1885, in various parts of Northern and Central London, which was definitely traced to the consumption of milk from a farm at Hendon, and which has formed the subject of a report by Mr. Power, of the Local Government Board, who, in conjunction with Dr. Cameron and Mr. Wynter Blyth, fully investigated the circumstances. The case and the Report on it are so recent as to be fully within your knowledge. It is sufficient to remind you that the cows which communicated the disease were suffering from vesicles and ulcers on the teats and udders, and that this affection was contagious and spread from cow to cow in the sheds. The affected cows continued to take their food well, and gave an abundant supply of milk all the time of their illness. The disease, further studied by Dr. Klein, is shown to consist of small vesicles making their appearance on a greatly swollen and red teat, in the course of a couple of days assuming the character of an ulcer covered with a brownish scab, having a slightly indurated base, the margins of the ulcer not being perceptibly raised or reddened. The ulcers affected chiefly the teats, but in some the udder also, and in these cows patches of skin denuded of hair were noticed on

* Report of the Medical Officer of the Local Government Board, 1882, p. 63.

the back and tail, the epidermis being scaly and the cutis more or less thickened. The milking power and body temperatures were normal.

Experimental researches, founded on Mr. Power's first cases —the outbreak of 1882—and conducted by Dr. Klein, have shown: (1) that the lochial discharges of a reputedly healthy cow did not, when inoculated into or administered along with food to certain other animals—as pigs, rabbits, dogs, and guinea pigs—produce in them any obvious illness; but (2) that a form of illness, viz., an abscess, could be produced in a healthy milch cow, recently calved, by inoculating it with muco-purulent throat discharge from a scarlatina patient, and that this disease was transmissible to dogs by inoculation after a short period—four days—of incubation; and (3) that the lochial discharges of an unhealthy—probably tubercular—cow, recently calved, when mixed with its milk, was capable by inoculation of producing inflammation and abscesses at the seat of inoculation in other animals, as dogs and pigs. Subsequent researches, however, led to the belief that this animal was in reality suffering from bovine scarlatina.

Researches conducted by Dr. Klein on cows from the Hendon Farm, which were the cause of the recent epidemic, have shown (1) that matter from the ulcers on the teats inoculated into the corium of calves produced a definite local disease allied in character to that from which the cows suffered; (2) that inoculation with sub-cultures of a strepto-coccus—a micro-organism contained in the discharge of the ulcers—into the sub-cutaneous tissue of calves, was capable of producing a general disease characterised by changes in the kidneys—glomerulo nephritis—and other organs, bearing a close resemblance to human scarlatina. The milk of these cows did not appear to contain any virus, but as Dr. Klein points out, the milk, during the act of milking, is pretty sure to become contaminated by the fingers of the milker bringing down into the milk particles from the ulcerations on the teat. The organisms contained in these particles would find in the milk a good medium in which to multiply, and the milk would then correspond to an artificial culture of the strepto-coccus. Whether such milk can produce the disease in calves by feeding as it can by inoculation remains to be determined. The teaching of the recent epidemic would seem to show that as regards human beings, consumption of the infected milk alone is sufficient to produce the disease scarlatina.

Diphtheria.—Milk epidemics of diphtheria have not been so numerous as those of enteric fever or scarlet fever, and unlike these too, it has not been possible, in a large percentage of the

total cases, to trace the actual source from which the milk derived its infective quality. This is not to be wondered at, for, in the first place, our knowledge is not yet sufficiently definite to enable us to exclude diphtheria from the class of diseases which are not necessarily dependent on a pre-existent case, and which, possibly arising from ordinary insanitary conditions, may be said to have sometimes a *de novo* origin; and in the second place, slight cases of diphtheria are very difficult to trace, the diphtheritic character of a sore throat not being always recognizable even to a medical attendant. There is but little evidence tending to show that diphtheria, like scarlet fever, may be a cow disease transmissible to human beings. Calves have been known to suffer from a throat affection, presenting post-mortem appearances very similar to those found in human diphtheria. But this disease of calves—even if it were more general than it is—would not account for diphtheria appearing amongst the customers of those establishments—the large majority in or near large towns—where the calves are sent away as soon as born, and the cows come after three or four days into regular milking. The question has been raised whether garget or mammitis in cows is capable of producing diphtheria in the consumers of milk taken from gargety udders.

An outbreak of diphtheria at Hendon, in the winter of 1882-83, was investigated by Mr. Power,* and was attributed by him to a ropiness of the milk supplied from a particular farm, possibly due to garget in the cows, although no evidence was obtained of this or any other disease being prevalent at the farm amongst the cows prior to the outbreak. Dr. Vacher, of Birkenhead, asserts† that garget, or mammitis, is a purely local non-specific disease, not communicable to other cows, but produced by cold, high feeding, or bruising of the teats by bad milking, and capable perhaps of producing indigestion and diarrhœa, when gargety milk is mixed with good milk—as it often is—but without the power to produce erysipelas, tonsillitis, or diphtheria in the human subject. It certainly seems, from the evidence we possess, as if diphtheria is capable of being transmitted in milk from farms and dairies which are carefully kept and in good sanitary condition, and where apparently there has been no pre-existent case of the disease. Under such circumstances, it is only natural to look to the cows themselves as the cause of the disease. Unfortunately, the skilled investigations have usually followed an epidemic at such a long period after the first case of the disease, as to have given sufficient time for the cows to have recovered from the disease, whatever it may

* Report of the Medical Officer of the Local Government Board, 1883.
† Sanitary Record, February, 1882.

have been, which gave rise to the epidemic. Such a disease, too, may be of a very mild character in the cow, running its course in a few days. We may expect considerable light to be thrown upon this subject shortly, from the researches now being undertaken by Dr. Klein for the medical department of the Local Government Board.

Tuberculosis.—Tuberculosis of cattle is extensively prevalent in the cowsheds of large towns and cities. From an Australian Parliamentary paper lately published, it appears from investigations recently made that at least 10 per cent. of all the cattle sold in Melbourne show unmistakable signs of the disease. In Germany 15 per cent. of all cattle are said to be affected with tuberculosis, and in some districts as much as 50 per cent.; whilst Prof. Fleming asserts that at least 25 per cent. of all dairy cows kept in towns are the subjects of the malady. In his work, "Veterinary Sanitary Science," the same authority says: "Cattle kept solely for dairy purposes, and particularly in large towns, suffer by far the most severely from this affection. Constantly confined in stables which are not always well ventilated and clean, deprived of exercise, drained of milk in large quantities, and fed on the kind of aliment which most favors the increase of that fluid—though it may not enhance its quality—it cannot be wondered that the nutritive functions of the cattle so treated must suffer to a serious extent. Indeed, it is a matter of daily observation that the cows which are abundant milkers are most liable to this disease." The practice of rearing store calves on milk deprived of its fat, must also largely favor the early onset of tuberculosis. The first signs of the disease are said to be very obscure, and an animal may be suffering for months before any illness is noted. The udder is one of the glands not unfrequently involved in tuberculosis, and this fact has an important bearing on the subject of the transmissibility of the bovine disease to man, for it is said that the disease is most readily communicated by the milk when the affection in the cow is general—not localised in one or two organs—and when the mamary glands are involved by tubercular deposits. The milk, too, is altered in quantity, more watery, bluish-tinted, and contains a larger proportion of alkaline salts, but is less rich in nitrogenous matters, fat and sugar, than in health, proving that assimilation is defective. Six months or a year may elapse before the symptoms become well marked.

As regards evidence of the transmissibility of the bovine disease to other animals and to man through the milk, Klebs, Gerlach, and others, have shown that the milk of tuberculous cows, given as food, produces tuberculosis in rabbits, guinea pigs,

and dogs, and Klebs asserts that tuberculous virus exists in the milk of phthisical cows, whether they are slightly or seriously affected. Cases too have been recorded in America, where the onset of tuberculosis in children was attributed to the consumption of the milk of diseased cows. On the other hand, there are some who do not believe in the transmissibility of the disease, and regard the diseases, as manifested in men and cattle, as being analogous only and not identical. This view can hardly be maintained now, when we know that the bacillus of tubercular deposits in cattle is the same as that found in the human disease. The subject is one of very great importance and interest to the whole community, and requires further elucidation by observation and experiment.

Cattle Plague or Rinderpest.—Of the milk in this disease, Prof. Fleming says: "There is no evidence that its use is likely to prove hurtful, and were it otherwise, the diminution and suppression of this fluid at a very early period of the disease must effectually prevent any accidents, were they likely to occur."

Contagious Pleuro-Pneumonia.—The same authority says: "We have no evidence that its use as food has ever caused any injury to those consuming it." Loiset states that at the public abattoirs at Lille, the employés of the cattle dealers and salesmen have consumed the milk obtained from diseased cows for a large number of years, without the slightest inconvenience.

Cow Pox or Vaccinia.—The milk is said to be altered in quality, coagulates readily, and is more watery; the secretion is sometimes diminished or suppressed.

Anthrax.—The secretion is quickly suspended, or if it continues is of a dirty bluish color, streaked with blood and soon becomes putrid. Chisholm mentions the case of a girl three years old, who presented all the symptoms of anthrax from drinking the milk of a diseased cow. Anthracic milk has also communicated the disease to other animals.

Rabies.—Prof. Fleming says: "There is no evidence to show that there is any danger in utilizing the milk before symptoms of the disease appear. People have continued in good health who have used the milk even at the commencement of the disease."

Foot and Mouth Disease, Aphthous Fever, or Epizöotic Eczema.—This is a contagious disease, characterised by an eruption of small vesicles, either confluent or isolated, on the lining membrane of the mouth and the interdigital spaces of the feet; the vesicles not unfrequently appear on the udder and teats in cows. The symptoms are fever, gradual diminution in the secretion and yellow color of the milk, whilst in the majority of cases it is nearly or altogether suspended. The udder becomes red and

tense, and the teats swollen and painful when they are involved, vesicles frequently forming on them. After a few days, the ulcers resulting from rupture of the vesicles are healing, and the secretion is restored. The course of the fever in ordinary cases is from eight to fifteen days. In the milk, large granular cells or white corpuscles, having the general character of pus globules, are present throughout the whole course of the disease, and even for some time after recovery. The specific gravity is lowered, and the milk rapidly decomposes. The contagium exists in its most concentrated form in the lymph or serum of the vesicles and in the saliva, but it exists also in the secretions, milk, and blood of diseased animals as well. The contagium possesses a long vitality and is very enduring.

The French Scientific Commission concluded that the milk in Epizöotic eczema was harmless, and in 1810, 1811, 1834, 1835, when the disease was very prevalent in Paris, no precautions were taken with regard to the milk and yet no epidemic prevailed. That the milk in Epizöotic eczema is always harmless is very far from being the case, numerous epidemics of a peculiar illness having been traced with much certainty to the use of such milk. One of the most striking of recent epidemics of such a disease occurred in Dover and its neighbourhood in 1882, the circumstances of the outbreak being investigated by Dr. Robinson. The illness from which a large number of people suffered was severe, there being high fever, vesicular eruptions on the throat and lips, and marked swelling of the lymphatic glands of the neck. It was clearly traced to the use of milk from cows with foot and mouth disease. In 1869, Dr. Thorne Thorne investigated the circumstances of a number of epidemics of foot and mouth disease, and the effects produced on the human subject by the consumption of milk from cows so suffering. The conclusions given in his Report* have been fully borne out by more recent experiences, and accurately summarize our more recent knowledge of the subject. They are as follows:—(1) "That a disease appears sometimes to have been produced in the human subject, when the milk of cows suffering from foot and mouth disease has been freely used without being boiled. There is no evidence to show whether this affection is of a specific nature or not; but it seems to consist in a derangement of the alimentary canal, accompanied by febrile disturbance, the presence of vesicles on the mucous membrane of the mouth and tongue, which, having ruptured, leave superficial ulcerations, and at times an herpetic eruption about the exterior of the lips."

* Twelfth Report of the Medical Officer of the Privy Council.

(2.) "That in a very large number of cases the milk of cows undoubtedly affected has been used without producing any noticeable morbid effects. This absence of result may, though only to an inconsiderable extent, have been due to the smallness of consumption and the boiling of the milk." Or, as I consider probable, it may have been due to the udders and teats of the cows supplying the milk not being affected. When there are vesicles present on the teats, it is probable that they are ruptured in the operation of milking, and the virus in its most concentrated form gains access to the milk. Whilst, if the teats are unaffected, to communicate the disease the virus must be present in the milk as a secretion. If such be really the case, it is probable that its presence is limited to a short period of the disease, consequently the milk may be contagious only for a short period of the disease.

By the Contagious Diseases Animals Act, 1886, the powers formerly vested in the Privy Council to make orders with regard to dairies, cowsheds, and milkshops are transferred to the Local Government Board, and outside of the metropolis, the local authorities under the Act are now the local sanitary authorities under the Public Health Act, 1875, whilst in the metropolis the Metropolitan Board of Works retains its position as local authority. This transference of power from the county magistrates to the local sanitary authorities should effect a great improvement in the regulation and management of dairies, cowsheds, and milkshops. The police constables, who were the officials appointed by the county magistrates to carry out the working of the Milkshops Order of 1879, were utterly incompetent, and the order was practically a dead letter. A new order by the Privy Council came into force in 1885, and this will now be carried out by local sanitary authorities acting under the Local Government Board. Thus country and provincial medical officers of health will at last have the control of dairies—so long denied them, and still denied to their metropolitan brothers—and we may expect a fairly efficient control and regulation of the milk trade. It will be necessary, under the light of recent experiences, for medical officers of health, who desire to perform their duties thoroughly, to acquire some veterinary knowledge, and to keep themselves cognisant of all that is now being learnt of cow diseases in relation to the spread of epidemics. It is one of the most serious aspects of the question, that cows which are suffering from any disease require—as part of the treatment—to be regularly milked, and that the farmer believes that mixing such milk with a large quantity of healthy milk is a harmless proceeding. This belief will have to be strenuously combated. It will be necessary in the future

to quarantine cows that are suffering from even slight and undefined illness, until our knowledge is more definite; to prevent cows coming into regular milking for business purposes, until sufficient time has elapsed after parturition for the lochial discharges to have ceased and for the animal to have recovered its health; to have an eye to cleanliness in milking operations, and generally to exercise throughout the country such a supervision that the existence of disease amongst dairy hands and their families, or amongst the cows themselves, may no longer pass unrecognised. The Milkshops Order of 1885 contains the necessary powers to prevent and control any and every kind of disease which may arise in farm or dairy; it remains that an enlightened public opinion should insist on their proper enforcement.

Mr. Wright Neesom (Hull) in opening the discussion remarked that reference had been made to tuberculosis. Cows which were affected were usually the best milkers, and from experience he had found that the best milkers were usually the best bred animals. It was suggested in the paper that Officers of Health should possess sufficient knowledge of cows and their diseases to enable them to make an inspection of them. He thought, however, that it was highly important that the urban districts should appoint their own officers—men thoroughly competent to inspect cow-sheds and dairies. Tuberculosis was a disease which he had had no difficulty in recognizing when it appeared. He thought it was highly important that the urban authorities should appoint for the inspection of cow-sheds and dairies men who possessed knowledge of cattle which qualified them for the position. He trusted that sooner or later tuberculosis would be included in the schedule of diseases dealt with by the Contagious Diseases (Animals) Act.

Professor W. H. Corfield (London) thought the section owed a debt of gratitude to Dr. Parkes for the able paper he had read. When they considered what an important food milk was, not only to children, but to adults, they saw at once the importance of considering the possibility of such diseases as scarlet fever—a disease which caused about one-fourth of the deaths from fevers—being spread by it. He referred to a large outbreak of enteric fever spread by polluted milk in Marylebone, and described how it was traced to its source, a work in which he had himself taken part. Referring to the supposition that diphtheria was communicated by infected milk, he said there was no direct evidence that the disease had ever been communicated in that way, but as it had been shown that it could be spread by means of polluted water it was evidently possible that

such water might be mixed with milk and contaminate the latter. The suggestion which had been made that diphtheria arose from a disease among cows known as "garget" was a mere guess.

Mr. S. W. North (York) said when they considered the consumption of milk and the various conditions with which they were surrounded, the wonder was, not that there was disease arising from its consumption, but that diseases were not more prevalent. He had all his life been of a strong opinion that a large amount of the disease from which they were suffering arose from the milk supply.

Dr. J. F. J. Sykes (London) drew attention to the fact that what they had heard in the paper just read, showed the importance of all milk being boiled. That was a great improvement of cow's milk before using it as food. If quickly boiled it would be much more easy of digestion than when uncooked. Boiling was such a simple preventive of disease that everybody ought to adopt it. The flavour was rather altered, but it was afterwards enjoyed quite as much as raw milk. The taste in either case being an acquired one.

Dr. A. Hill (Birmingham) spoke in favour of veterinary surgeons inspecting the cowsheds and animals. One point of the subject that had not been referred to was the adulteration of the milk with water. He regarded that as a more serious offence, but he was sorry to say that in many cases, although so much disease might arise from it, magistrates regarded it with a considerable degree of indulgence. He quoted a case in which 60 per cent. of the milk sold was "added water," and the magistrates inflicted a nominal penalty. He thought Dr. Sykes went to the root of the whole matter when he said that they should boil the milk, and he believed that if every household took the trouble to boil the milk no danger would arise from drinking the milk from infected animals.

Mr. H. H. Collins (District Surveyor of the City of London) congratulated Dr. Parkes on his paper, and on the fact that he had an audience which included a large number of ladies who were likely to give effect to the practical suggestions in the very able paper read by him.

Dr. Louis Parkes (London) in reply to the various observations, said he approved of boiling the milk, but the difficulty which arose was to compel people to boil it. They could not compel the general public to do so.

On the motion of the Chairman, a vote of thanks was accorded to Dr. Parkes.

On "The Prevalence of Defective Eyesight," by JOHN OAKLEY, M.R.C.S.

SO much has been written on the subject of the prevalence of short and long sight, eyesight in schools and in workshops, it would seem to be superfluous to again bring forward the subject. But as long as the evil exists and is increasing, and as long as the causes, which are removable or can be ameliorated, are allowed to exist, I think it is the duty of every observer to add his testimony to such growing evil; and as far as it is in his power to point out what measures should be taken to stay this progressive mischief. Deafness, on the other hand, has not received that attention which it deserves; it is both to the affected and to the friends a great calamity. The child that has either been born or has become deaf is debarred from all interchange of thought, he is backward in mental development, and in his progress through life he is handicapped all round.

To the poor man deafness means want of employment and poverty.

The possession of good vision and hearing is of immense importance in the early years of life. The receptive faculties of the brain are then in their highest state of activity. Impressions are then received and images stored up which are never acquired with equal clearness in after years; and if the vision or hearing at this period be seriously impaired, the whole system of education is practically stopped.

The blind and deaf child's education in one or other of the numerous schools for such is systematic and continuous. But this is not the case with the child who has only impaired vision or hearing. Months and years are often allowed to elapse in hopes that improvement will take place—that the child will some day be able to receive an ordinary education and acquire the common information that children possess, and, in the meantime, left to himself and neglected at the most critical period of his life, he grows up ignorant of the rudiments of knowledge, and, if in time he should recover any useful vision, he will find himself placed at an immense disadvantage as compared with those around him who can see and hear well.

The causes of defective sight and hearing are many, but hereditary predisposition must always come first, although on this point there is much difference of opinion. But there is not the least doubt, that under similar circumstances the children of parents who have defective vision and hearing are

more likely to acquire the same faults. How or in what manner, these transmitted tendencies affect the different tissues of the eye and ear, is not yet positively known.

The most important cause of defective vision in new-born infants is injury to the retina by exposure to intense or dazzling light, which not only may produce temporary or permanent diminution of the sensitiveness of the retina, but may also partially or completely destroy the power of vision. Add to this, want of cleanliness, impure air, exposure to cold either by draught upon the face, or by the subjection of the whole body to a sudden change of temperature, and a chill of the whole body may be occasioned by putting on damp garments.

But the greatest damage is done to infant's eyes by ophthalmia—the ophthalmia neonatorum, commonly called purulent ophthalmia. This disease is most contagious; when in Paris, in the year 1866, in the Hôpital des Enfans Malades a severe epidemic occurred and M. O. Reveil, a well-known practical chemist analysed the air of the wards and he found that it contained globules of pus, together with scales of skin which were so dry and light that they floated about on the slightest disturbance of the dust or the admission of a current of air, and the admission of one of these dessicated scales into the eye was sufficient to reproduce the disease.

This disease has been the cause of blindness to 37 out of 89 pupils in the Wilberforce School for the blind; 70 out of 217 recorded cases at the Deaf, Dumb and Blind Institution at Belfast. And according to Dr. Haltenhoff it has caused the blindness of 33 to 50 per cent. of the total number of blind in various countries. These statistics only give you the blindness of both eyes. But I wish to draw your attention particularly to those instances in which only one eye has been lost, and of those in which there has been permanent impairment of the vision of either one or both eyes; or in which with no visible sign of impairment there has been such an alteration in the tunics and tissues of the eye as to materially alter the natural curvature of the front of the eye.

There can be no doubt that the number to be classed under the head of permanent impairment of one or both eyes would far exceed the number of those totally blind.

When the period of infancy is passed, and as soon as children begin to use their eyes more closely, the time has arrived when defects arise which point to errors of refraction.

It is well known that the difference which exists among adults in respect to the distance, the acuteness, and the duration of vision are exceedingly great.

One person, who reads the finest print near to the eyes, will

scarcely recognise friends when they are two or three yards away. This, in scientific language, is called "*Myopia.*" While another, who can see the hands of a clock far off, requires spectacles to read at all, "*Hypermetropia.*" There are others who cannot see lines horizontally or vertically, "*Astigmatism.*"

Myopia is, without doubt, increasing, and in the presence of an increasing educational pressure it is of great importance that we pay much attention to it. The causes which contribute to the production of myopia are complex. We have first the hereditary predisposition, then there are exceptional causes connected with the abnormal conditions of circulation and nutrition in the eye, the excessive use of the eyes on near objects involving excessive conveyance with traction on the coats of the eye, accommodative strain and congestion due to the bent position of the head. And there is no doubt that close application in early life with strong mental effort is the main cause of the prevalence of myopia.

The chief causes of deafness are exposure to chills and to the shocks of loud sounds. The auditory nerve of an infant is much more sensitive than that of an adult, and can therefore ill bear the shouts and noise it has frequently to endure during the first few hours of its existence, and certainly I have found that much harm has been done to the sensitiveness of the nerve during the first few days of an infant's life. Exposure to wet, damp feet, neglect to change damp clothes, washing the head too frequently and then imperfectly drying it. Measles, whooping cough, scarlet fever, mumps, are the diseases which cause much impairment in hearing. The ear is much more liable to be affected by a succession of slight attacks of cold than by a single severe one.

Catarrhal deafness is very common, and although amenable to treatment when attended to, yet if neglected leads to deafness of a usually severe and intractable character. The friends of a deaf child have not the slightest notion that it is hard of hearing, and they are too apt to think that he is careless and obstinate, and the disease is often increased by frequent boxes on the ear for inattention.

Debilitated children with enlarged tonsils are very liable to repeated attacks of slight catarrh at the back of the nostrils and the throat, which gradually extending up the eustachian tube to the middle ear, sets up inflammation which, if neglected, ends in more or less deafness.

Most large schools are heated by hot water, and without very good management the rooms vary much from time to time in temperature. As a rule they are generally too warm, then the children are turned out into the playground in all weathers

with insufficient clothing and no covering to the heads, and the weakly children are as a result frequently suffering from catarrh. There is no doubt that this is one of the chief causes of slight deafness. Much of what I have said must of necessity be a reiteration of matter well-known to many of you, and most probably has from time to time been brought before this society, but as there is still much to be done to arrest the advance of preventible diseases, both to the eye and ear, in young children, it is well to keep these subjects before a society which is striving with might and main to spread all necessary knowledge in preventive medicine.

Seeing that every year there is an increasing educational pressure, it is most important that every attention should be given to the prevention of defects of sight and hearing, for when there is any impairment in these two senses, the education of the child is conducted under very great difficulties, and the child's knowledge of the outside world is frequently most erroneous.

Whenever parents possess the knowledge of the existence of any hereditary predisposition, it is always well for them to consult their personal medical adviser as to the measures necessary for its eradication or amelioration in their children.

It should be the duty of every medical man on the birth of a child to see that the eyes are immediately and properly cleansed, then to drop into the eye a drop or two of a very weak solution of nitrate of silver, and then to explain to the parents and nurse the measures to be pursued to secure cleanliness and protection from any sudden or dazzling lights, and the conditions under which the child should be placed to secure it from draughts and colds. The Obstetrical Society of London have published a code of rules as to the management of infants, and Professor Fuchs, in his classical work for the prevention of blindness, has laid down rules which should be in the hands of all who have the care of infants.

It has been suggested that those rules should be published in a form that could be distributed through the medium of the Poor Law and Birth Registration Organisations, but in my opinion this would not suffice, for parents rarely register the birth of their children within the month.

The only efficient manner in which such pamphlets could be distributed, would be for the person who attends a woman in confinement to distribute them.

There are no doubt cases in which in spite of everything the result may be unfortunate, but they occur so seldom that they need hardly be taken into account. Surgeons are however all agreed on this point, that the present resources of medical

science are, "*if availed of in time*," sufficient to prevent the ravages arising from ophthalmia, which occur in infancy. I have myself attended some thousands of confinements, and have been able to follow up the cases of children who have been more or less affected in infancy; and there is no doubt that very slight inflammation of the eyes, and especially where there is some specific disease, does affect its curvature, and so produce that defect which is so very difficult to remedy. I speak of astigmatism.

As soon as the child begins to observe with intelligence the time arrives when it is the duty of all parents to examine the condition of the sight and hearing of their child, and finding any deficiency to see that it is either corrected or measures taken to prevent the advance of the defect. Much may be done by the parents at this period of the child's life to educate the senses of sight and hearing. The proper use of the eyes is a matter of education, and although this is generally an unconscious process, it is, nevertheless, one which parents may promote by judicious interference. The trouble that they take in order to guide the child towards the acquirement of habits of careful visual observation will be well repaid when they find that later on the child having acquired the habit of close attention is able to acquire knowledge in much less time than he otherwise would do. And this, in a myopic child, is of great importance. The child should never be allowed to read or write, or even to draw by an insufficient light.

Most important of all, the child should not be overburdened with tasks which call for close application of the eyes, and he should be early taught in reading or writing to maintain a position in which the head is not suffered to fall too far forwards.

As soon as the child enters school-life, the teacher should examine into the condition of the sight and hearing; for this purpose specially prepared test types should be supplied and a tuning-fork; and if he finds that there is any impairment, he should at once communicate with the parents, and the responsibility of seeing that it is corrected or relieved should rest with them.

Such a systematic examination, although it would give a little extra trouble to the teacher at the beginning, would, later on, be the means of saving him an immense amount of time in their education; and knowing the children who were defective either in vision or hearing, he would be able to place them under the best conditions for work and for the special defect under which they suffered.

Children who are defective in vision should have special

attention given to the postures in which they work. The desks should be so constructed that the child can sit with shoulders square, the work exactly in front, and the eye at least twelve or fourteen inches away. The light should be good and, if possible, proceed from the left side.

Professor Snellen, in a paper on the subject of desks and seats, has described a systematically graduated series of desks, the measures are given in the metrical system and are most complete. The exhibition this year, no doubt, will shew a great improvement in the construction of seats and desks, and if only they can be made at a low cost they will soon displace those made under the old system. The books should be of large clear type and should be printed on good paper, and the books should not be too large and heavy, and the lessons should not be so long as to exhaust the power of attention. Children should not be burdened with serious study in the evening when the whole system is exhausted. Home lessons are a great evil, more especially to the poor children who have to do the work under bad hygienic conditions, with a poor light, and the noise of the children greatly interferes with their attention, and thus makes the work still more difficult.

During the last ten years I have carefully examined the conditions of the defects of these two senses, and within the last five years there has certainly been a marked increase, and that more in the hearing than the sight. The reason may probably be that more attention has been given to the sight.

When a child has shewn complete deafness there can be no doubt, but where it is incomplete or slight it does escape notice, and as the causes which started the evil are still in existence, the disease advances with slow and sure progress.

It is most important that parents should give more attention to the slight ailments connected with the ear—they are too much neglected under the impression that they will get well of themselves, or that any interference will make them worse.

Scarlet fever, of all the Febriculæ, is the great cause of deafness among children, and the ears in this disease should be watched most carefully.

To prevent the catarrhal deafness, mostly caused by a succession of slight colds, it is absolutely necessary that more attention be given to the clothing of children, that they have the means of changing their damp clothes, boots and stockings before sitting down to their school work, and that when they are turned out into the playground that they are suitably clothed, and more especially that they have some covering for their heads.

There is one point to which I would especially draw your atten-

tion, and that is that when a child of five or six years of age or upwards loses its hearing, if it is able to read, it should be made to do so several times during the day, by such exercise the child will retain all words that it has previously known, and so the child will be prevented from losing speech; of course the rest of its education will have to be conducted under the new method of lip reading.

To have filled my paper with statistics would have taken up too much of your time. They can easily be obtained from works on these subjects. As far as possible I have confined myself to my own personal experience of eighteen years practice in the large town of Halifax and its neighbourhood, and if my communication to you to-day may help, however little, to lessen the advance of these defects in sight and hearing, I shall feel that my work has not been in vain.

In answer to a question, Mr. Oakley replied that the solution recommended was made of two grains of nitrate of silver to one ounce of water.

Dr. J. H. Buchanan (Thirsk) remarked that to drop into the eye of a new born infant a solution of nitrate of silver seemed like a meddlesome interference with nature. He did not think that even nature intended two drops of nitrate of silver to be dropped into the eyes of a babe so soon after birth. If there were evidence of disease, or if the sanitary conditions surrounding the house rendered it necessary, then by all means do so; but to recommend it as an ordinary point of obstetrical attention, seemed to him like a piece of meddlesome interference, and might provoke the very mischief it was intended to prevent.

Mr. J. Oakley (Halifax), in reply, said prior to 1874, he had several cases of ophthalmia, but since he adopted the practice, although he had had thousands of confinements, he never had had a single case, and the children did not suffer pain from it. Since its adoption in Vienna, the number of cases had reduced about 75 per cent.

The Chairman, Professor de Chaumont, said that in the Maternity Hospital in Paris the number of new-born children who suffered from ophthalmia was large, and there was hardly a case of recovery,

the eyes were generally destroyed. A large number of cases were shown to have arisen from the pollution of the atmosphere.

On the motion of the Chairman, a vote of thanks was accorded to Mr. Oakley for his excellent paper.

On "Sanitary Associations, their Mission and Methods of Action," by J. MALET LAMBERT, M.A., LL.D., Vicar of Newland, Hull, Member of the Hull School Board and Hon. Sec. of the Hull Sanitary Association.

IN asking your attention for the subject of this paper, I feel it necessary to define what seems most properly to be the position it occupies in the work of a Congress of so important a character as the present one.

If the object of the Congress were purely the advance of sanitary science into regions of knowledge yet unexplored, then it would, I confess, have no place. But the objects of the Sanitary Institute are not only "the advancement of sanitary science," but also "the diffusion of knowledge relating thereto," and, carrying the application of this knowledge into practice, also the realisation of this diffused knowledge in improved sanitary arrangements for our population.

It is especially in these two last departments that the work of Sanitary Associations claims a recognition in the deliberations of this Congress.

It is sometimes a long journey to travel from the certain discovery of a scientific truth, through its gradual admission by the educated world, to its incorporation into the beliefs of the mass of the people and its final fruitful result in wide-spread benefit to mankind. The hand that laboured and the brain that strained for its first proof often lie in deep silence before their work is recognised and bears fruit. Evils which plague the world often prolong their baneful course while the slow process of the diffusion of knowledge is taking place. In no department of science is this more true or more striking than in sanitary science. Had the laws of sanitation, as known a generation ago, been acted upon, the social condition of Great Britain would in many respects be different from what we know it to be. Of those who are living to-day, many thousands

would be healthy and strong who are now dragging on a life of stunted capacities and lingering disease.

The knowledge was there among scientific men, but it was powerless. Before it, barring the way to its progress, stood the existing habits of society; institutions, the growth of centuries, in accordance with those habits, vested interests in dirt of all kinds, even superstition, as if the worship of Beelzebub, the great God of flies, were rearing its long-forgotten front under a modern form. So the sacrifices of comfort and decency and health and life went on as if the great truths of sanitary science had never been known to man. Happily, the diffusion of such knowledge has now proceeded far beyond the limit it has reached at any previous time. The International Health Exhibition was in itself a national education. But the work falls very far short, even of that portion of the laws of health which may be said to be now proved as clearly and certainly as demonstration and experiment can effect. When we regard also the rapid increase in knowledge, which is being made from our present vantage ground, it becomes more than ever necessary to adopt whatever means of communication offer themselves between the world of science and the millions for whom science works. Let us not mistake our position. There are facts regarded by educated men as truisms, which are known only to be silently disbelieved by large numbers of others. Only a few months since a letter appeared in one of the Hull papers, advocating the view that decaying manure in the middle of a dense population was conducive to health and longevity.

What now are the means at our disposal for realising in practice the precious knowledge which is placed in our hands as to the origin and preservation of health? We have in the first place the means of influencing individuals by convincing them of the existence of natural sanitary laws, and by persuading them to adopt habits of life in accordance with these. But we have fortunately also other and swifter methods of action. Sanitary provisions have found their place in the Statute Book; and in the Public Health Act, the Artizans Dwellings Acts, and other legislation of a more local or partial character powers of a most sweeping kind are placed in the hands of local authorities. But it is well known that to procure the passage of bills of this kind through Parliament, is only a part of the work of carrying them into effect. To some extent their provisions are only permissive, when they go further and use the imperative, no sanction or penalty is attached to the neglect of their enactments. Hence it comes to pass that in many places they are in most important particulars a dead letter.

It may be thought that the Local Government Board super-

intends the carrying out of the acts, but with medical officers of health in country districts whose salaries are so nominal that they are not expected to attend to their duties, with the exercise of that remarkable ingenuity in obstruction and clever dulness of perception which local authorities are capable of developing, the superintendence of local effort from the Home Office falls very far short of efficiency. The manifold confusion of county government at the present time, and the lack of any continuity or unity of system in these matters in neighbouring districts, or between town and country, adds to the momentous shortcomings of the whole.

It is right, however, to state that the boroughs stand on a different basis from the counties, and that in the former we have struggling into existence a number of officials under competent medical officers who are making great progress towards efficiency. Here, too, the local government being in the hands of elective bodies, the latter are most amenable to public opinion.

I have now traced in outline the relative position of the various agencies at our disposal for the dissemination of sanitary advice, and the achievement of sanitary reform. I have done so at some slight length in order to bring into clear prominence the agency which is most lacking to give greater effect to what has been conceived by institutions such as this one, and to what has been intended by the Legislature. What is needed, is clearly organised voluntary local effort. We sometimes are justly severe upon the town council of some borough which has neglected its duty and sacrificed the lives of its constituents, but we should go further and analyse the causes of this neglect. The members of the town councils or local boards are elected chiefly for other purposes than those purely sanitary, nor have they, as a rule, had any training specially fitting them for sanitary work. They are individually subject to the influence of those vested interests in disease which are the great enemies of reform. The offenders are often not the poor, but some influential manufacturers or property owners. Medical officers hold office during the pleasure of the town council or local board in almost every case, and when anxious for reform are not allowed to undertake it. Under circumstances such as these proper action is almost impossible.

What is needed is a voluntary association of men of all classes, creeds and politics, whose motives are above suspicion, and whose business it shall be to ascertain clearly the actual position of affairs, to make it public, and then to put in motion the forces most calculated to bring about improvement. The rules of such a sanitary association need be only few and

simple, the demands it makes upon the time of its members not excessive, and the good it may effect is very great. Let me give a few plain hints as to the mode of action. In the first place the assistance of the local Press may be sought, and will generally be freely given. Public opinion may be stimulated by lectures couched in popular form, and by the distribution of leaflets and other literature. Supposing now that some grossly unsanitary area is reported to the association. A full and truthful description may be made public, and a complaint lodged with the authorities. Supposing further that the matter is passed over at the next meeting of the town council, let public attention be again called to it in proper terms ; let the honorary legal adviser to the association, if it be fortunate enough to include such a gentleman among its members, point out the duties of the authorities, and let the description of the nuisance and the legal remedy be again forwarded to the authorities. If still neglected, other weapons are at hand; possibly a municipal election draws near, and the support of members of the association may be valuable. If other measures fail and the health and wellbeing of the people are jeopardised, stronger measures may be justified. Let the obstructives be proclaimed in the Press, denounced from the platform, even gibbeted in the pulpit, until the force of public opinion rouses them to action. When once the consciousness of the real issue at stake dawns upon the working-classes, they will insist on its being rightly decided ; or, as a last resort, the mode of action provided by law of appeal to the Local Government Board on behalf of the ratepayers may be adopted, and the central authority be called upon to exercise its powers of control.

It will not, however, in most cases be necessary to adopt the extreme measures here described. The sanitary committees of the various corporations and their medical officers will be often really glad of the increased force of public opinion raised by such an organised effort as I have spoken of, and the two bodies may carry on their work without coming into collision, but it must be one of the duties of the sanitary association to watch the action of the public authorities, to endeavour to guide it aright when swayed from its pursuit of health by other considerations, and to supplement its work by voluntary effort. It cannot of course be expected that such action will answer all the expectations of reformers, but that it will be able, if well directed and persevered in, to show considerable results cannot be doubted. Such has been the case in Hull, where a sanitary association has been actively at work for three or four years. We are far from agreeing with one member of that town council, that we have now sanitation to perfection in Hull, and

that the poor are as well housed there as in any town in the kingdom, for there are areas which are still a disgrace to the town which contains them, but much has certainly been done in awakening public opinion, notices to abate nuisances have been served and acted on in the case of many hundreds of labourer's dwellings, and the general verdict is that the extraordinary decline in the death-rate during the last three years, a decline which has attracted notice throughout the country, is in no small degree owing to our initiative.

If this be the case in a town like Hull, where sanitation must be carried out under many natural disadvantages, what must be the duty of those boroughs which still suffer under rates of mortality varying from 25 to 30 per 1000? It is not too much to say that no English borough which does its duty can possibly go on shewing such results. Lives are being sacrificed to ignorance and perversity, and those who might be enjoying the elastic strength of perfect health are wasting in the fetid atmosphere of overcrowded and malarious courts.

It is the glory of the science of to-day that it places in the hands of men the means, not of doing only isolated acts of good, but of acting directly on the sources of good and evil. The hydra-headed enemy, disease, can be attacked while in the germ. If there be no lack of men and women who will go forth to relieve suffering and give comfort in sickness, will there be a lack of those who will stand in the narrow pass where the invading host can be withstood and turned back ere it spreads its vast destroying forces over the land? Surely not. Such a work is in the highest sense Christian. Over multitudes of the poor unhealthy surroundings hang like fate. To know their danger is for them to know also that it cannot be escaped from. It is for others to dispel the dark cloud that shadows their weary lives, and to admit the gleam of the sunshine of health into every English home.

Mr. R. H. B. Nicholson (Hull) had great pleasure in supporting the reader of the paper. They had met that day as a protest against the unsanitary conditions of many of the surrounding towns and county districts. Sanitary associations, such as that at Hull, were independent of any central authority—they were a self-formed association, with no selfish object. At Hull they had met with the support of Clergy and Ministers of all denominations, and had the Archbishop of York as their president. Many members of the sanitary authority were glad of their assistance. He hoped sanitary associations would be formed all through the kingdom; their desire was not to obstruct

but to assist sanitary authorities by the diffusion of knowledge by means of leaflets, lectures and the press, so as to instruct the public at large on the importance of sanitation.

Surgeon-Major Pringle (London) referred to the "sweating system" adopted by owners of property in London, and hoped it was not carried on in Hull. The principle of the system was to allow the property at the close of a lease to fall into an unsanitary condition, to refuse to repair it, and to let it to the tenant who wanted nothing done. A sanitary association could protect the poorer classes from being compelled to live in such property, and societies which were independent and above suspicion could help the poor by boldly stepping forward and taking action against the owners of such unsanitary property.

Mr. J. Oakley (Halifax) thought that until something was done to establish a centre in London, and to appoint a Minister of Health, the system of sanitary associations could not work as satisfactorily as it ought to do.

Dr. J. F. J. Sykes (London) said sanitary associations, as referred to, might be very good and had a very excellent object in view; but sometimes their action, or the action of some who were very zealous, but having a limited knowledge of sanitary matters, worried the medical officer of health. He suggested that wherever such associations were formed they should take into their confidence the medical officer, who would always be ready to assist them, and welcome their support.

Prof. W. H. Corfield, M.A., M.D. (London), who now occupied the chair, Prof. De Chaumont being obliged to leave the meeting, remarked that at present inspecting officers had not the power to make an inspection of houses against the wish of the tenant, and about which there had been no complaint. But, although that was so, for 33 years there had been medical officers of health and inspectors of nuisances going about London and continually preventing the spread of disease. Although the metropolis was the largest city in the world, yet owing to these exertions the death-rate was extremely low.

Dr. J. F. J. Sykes (London) remarked that in his district three inspectors were engaged in house-to-house visitation all the year round. They did not wait until complaint was made to them of nuisances that existed, they sought the nuisances out.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

On "The Appointment and Tenure of Office of Medical Officers of Health," by R. BRUCE LOW, M.D.Edin., S.Sc.Cert.Camb.; Medical Officer of Health for the Helmsley Rural District.

IT is generally admitted that the post of medical officer of health is a responsible one, requiring special knowledge, special tact, and special zeal. The state, for its own sake, has a considerable interest in securing for this appointment men of the best quality, and having secured, to retain them, so long as they continue to do good work. During the last ten or twelve years, men of high attainments and of good professional position have joined the preventive medical service. Many of them however have now abandoned it, disappointed and disgusted with the treatment they have received at the hands of the local authorities who appointed them. Some however still stick to their posts, restrained from desertion by a high sense of duty, and a deep desire to carry on the work they have begun, hoping against hope for some alteration in the tenure and appointment of their office. The public health service of this country does not at present attract men of mark to it. There are few medical men of average ability who would care to exchange, under existing circumstances, the independence of a fair private practice, for the bondage of a public health apppointment, let us say, in a large combined district, where the component authorities are fighting among themselves and threatening secession at every turn. The instability of these combinations leaves the medical officer of health at their mercy. The uncertainty from year to year of maintaining his position must interfere with the proper discharge of his duties. With a large proportion of persons, sanitation is unpopular. The medical officer of health who conscientiously pushes forward unpopular measures is liable to meet an undeserved fate, when his time for re-election comes round. The representatives of the ratepayers regard him as one who is constantly raising the rates. He is supposed, in the popular belief, to receive a large salary for doing "next to nothing." They look upon him as an expensive official, whose work anyone could do; in fact, I have known of a case where it was gravely proposed at a meeting of guardians, sitting as the sanitary authority, that each guardian should act as health officer of his own village, and thus save the rates a considerable sum annually. If a medical officer of health be active, many of these misguided representatives make it their aim to get rid of him, and replace him by one who will be less obnoxious, because less active. If they

cannot get rid of him, they can at least reduce his salary and force him to resign in self-defence, driving him back to private practice to earn his living. Can you wonder that the temper of the sanitary worker becomes soured, his zeal diminished, and his enthusiasm destroyed. If his salary be his sole source of income, the uncertainty of his livelihood must disturb his peace of mind and hamper his important work. The day of his re-appointment always attracts the foes of sanitation, who fight over again the battle year after year. Much malignity is often displayed on these occasions.

The medical officers of health in the large towns are much better off than their rural brethren. Public opinion is better educated in health questions. The comments of an enlightened public press keep down displays of ignorance and paltry prejudice, if they exist. It is not common to hear of gross injustice committed by the larger corporations towards their sanitary advisers. This better state of feeling between the sanitary authorities and their officers, is doubtless one reason why the cause of public health makes greater strides forward in the large towns than in the rural districts. Another reason why country places are behind the towns in sanitation, apart from the dissatisfaction which exists in combined districts, is the fact, that frequently the rural medical officers are engaged in private practice, and consequently find little time to devote to their duties as preventers of disease.

Opinions are divided as to whether a medical officer of health should, or should not, be debarred from practice. The majority are in favour of separating public duties from private practice. The minority, who believe that sanitary work can be satisfactorily carried out by general practitioners, argue as follows. The medical officer's district would necessarily, for the sake of his practice, be limited in extent, and he would therefore be able in his daily rounds to observe closely the incidence of preventible disease, and to discover any dangerous defects in the dwellings or surroundings of those with whom he was in constant contact. From his position as confidential adviser and family friend, he would be able to press forward his recommendations to rectify the sanitary shortcomings of the household. Being thus "in touch," so to speak, with the public, he would be able gradually to effect more good from a public health point of view, than if he had the supervision of a large area, and resided at a distance from many parts of his district. Unfortunately this picture has never been realised. Sanitary duties clash with private practice, and few men are found rash enough to peril their private practice for the sake of public sanitation.

The general practitioners who are engaged in public health work, may be roughly classed under three heads. *The first* includes those who accept the appointment, but who only do nominal work. They constitute what are known as the dummies of sanitation. They are sharp enough to see that it is against their own interests to press forward measures which are unpopular. Sanitary improvements always mean money, and the tenderest part of the average ratepayer is his pocket, and he naturally refuses to consent to the expenditure of money upon measures whose utility or object he does not recognize. The man who is in practice, and wishes to succeed must consult public opinion. Anything which damages his popularity, damages equally his practice.

The general practitioner who holds a sanitary appointment is handicapped, and unless he avoids, as far as possible, his unpopular duties, he is almost sure to suffer in the struggle for success. This sanitary salary is usually inadequate, and the temptation, therefore, is great to consider his private practice first, and his public duties last. It is unfair that he should be submitted to this temptation. The result of letting his sanitary work alone, is found often in the reports of the Medical Department of the Local Government Board, who have been compelled to send a skilled inspector to assist the authorities in freeing the district from the devastations of some epidemic disease. The valuable time of the skilled staff of the central authority should not be spent in doing the sanitary surveys, which every competent health officer is able to do for his own district, but should be reserved for the higher work of solving the obscure and important problems in public health, which puzzle, as yet, the whole profession. The consequences which result from neglected duties are far-reaching, extending beyond the locality itself, often involving other districts.

The second class of which I spoke, includes those practitioners who really do their sanitary work, but at the expense of their private practice. When such large questions as new drainage and water-supply come to be discussed, and the probable cost intimated, the taxpayers are appalled, and would risk cholera, typhoid fever, or any other disease, rather than pay their proportion of the expense. I am stating no imaginary case when I say, that the successful introduction of a new scheme of drainage or water-supply has cost many a health officer a slice of his practice. Is it just that medical practitioners should be called upon to make such sacrifices for the good of those who do not either acknowledge or appreciate their work? In addition to losing his patients, he is sometimes called on to suffer in another way. When the time of his re-election arrives, he is mortified

to find that his opponents have obtained a majority against him, and that a less scrupulous rival is appointed in his place, on the understanding that the less he meddles with sanitary matters the more satisfaction will he give to those who appoint him. The conscientious worker in this way loses the small prestige which attaches to the public office, and suffers the deeper humiliation of seeing a less competent man promoted to his post. With instances like these before them, the timid or the easy going are tempted to follow the pleasant primrose path which leads to favour and fortune. Even with men of a higher type there must always be a struggle when the path of duty leads to unpopularity and possible poverty. *The third class* is comparatively a small one, and includes those practitioners who are as successful in sanitary work as they are in private practice. They are usually men gifted with peculiar personal powers, and achieve success which, to men of moderate ability, seems impossible.

Before leaving the question of private practitioners in relation to public health appointments, I would just add one word about the friction which arises sometimes between the sanitarian and his medical brethren. When he is investigating the origin of an outbreak, he is brought into contact with the patients of other medical men. And although I am loth to believe that any member of our profession would demean himself so far as to make use of his official position to obtain the patients of others, yet this accusation is made, and a certain suspicion and jealousy does arise when the local health officer is a rival in practice.

The exclusion of medical officers of health from private practice would tend to prevent this friction in the discharge of their difficult duties, when brought into contact with practising medical men. This is an additional argument, if one were needed, for separating sanitary work from private practice. Further, it is impossible that any great contributions to the general stock of knowledge can be made by busy practitioners, whose time is entirely absorbed by their patients. The progress of preventive medicine is retarded for the want of a sufficient number of men who study and practice sanitation as a speciality. If the health officer be debarred from private practice, and if he have assigned to him a suitable area and population to occupy his whole time and furnish him with a reasonable salary, it is absolutely necessary, in the public interests, that he shall first obtain, before appointment, a special license or diploma in sanitary science. This would be a guarantee to the public that his knowledge of his special subject reached up to a certain standard. In addition to special knowledge and qualification, the medical officer of

health requires special tact and enthusiasm. Without tact men of the highest attainments have failed as medical officers of health. Without enthusiasm for his work he will be unable to withstand the assaults of his enemies, or to remain patient under the constant thwarting of his plans, and the unreasonable delays which the opponents of progress throw in his way. He needs much patience to persevere in spite of the dogged opposition with which his proposals are often met. To acquire tact, a large experience of the world, and much close contact with "all sorts and conditions of men," is needed. It must, however, be admitted that the man of tact, like the poet, "nascitur non fit."

To obtain enthusiasm for sanitary work, something more than mere scientific study is required. A practical acquaintance with the sorrows and sufferings of humanity must be obtained. The anguish that might be avoided, and the wrongs that might be righted must be seen and studied on the spot. The misery, grief, pain, vice and crime, which the sanitarian of the future is to prevent, must all be known and noted by his own eye: and if he have within him the materials for making a medical officer of health, his soul will burn within him to be up and doing, to drive such sorrows from the face of the earth. The recollection of the sufferings which he has seen, will help to rekindle his enthusiasm, should it ever grow cold. He must, with serious intent, mix with the poor and wretched, and note their needs. He must listen for "the voice of the people," and when he has once heard its sorrowful sound, his education will be complete, and his work is ready to be begun. To secure a thorough knowledge of the wants of his fellow men, it is necessary that the candidate for a health appointment should have seen some practice. In addition to acquainting himself with the human sorrows that can be prevented, he would acquire a better understanding of the feelings and wishes of his brethren in the medical profession, without whose co-operation the medical officer of health cannot hope to achieve much success. Besides this, he would obtain an experience in recognising the various kinds of disease, which he has afterwards to investigate. For example, much often depends upon the diagnosis of a zymotic. In this period of probation in practice, he would train his powers of observation so as to detect the smallest traces of those diseases, which he has to stamp out before they do injury to the population. Mere book learning, and hospital training alone, valuable though they be, cannot give him so good an experience as can be got in private practice, where zymotics, mild and severe, incubating and convalescent, can be seen and studied, alas, too often.

Having ascertained that candidates for the post of medical officer of health are duly qualified in sanitation, and are men of tact and zeal, who have gone through a thorough training, there could surely be no hesitation in placing their tenure of office on a satisfactory basis. No official is likely to do his unpopular work well, if his post be uncertain and at the mercy of agitators. It has been pointed out that the poor-law medical service offers a precedent as regards tenure of office. No one can say that this security of tenure has worked badly for the sick poor or for their medical attendants. The interests of both have been equally safeguarded, and although there may be something still to be desired, yet the position of a poor-law medical officer is properly protected, and gives satisfaction to the poor as well as to the profession. He cannot be removed by the caprice or resentment of the guardians, nor can his salary be reduced except with the consent of the Local Government Board. There must always be a full official investigation made before any change is permitted, so that practically his tenure is for life or good conduct. In reply to a deputation who waited on a previous President of the Local Government Board, asking for some alteration regarding the tenure of office by medical officers of health, the Right Honourable gentleman replied that the uncertainty of tenure was retained to serve as a stimulus to work, so that there would be no chance of health officers becoming indolent or neglectful of duty. You will agree with me that this reply conveyed an insult not only to health officers, but to the whole medical profession. If there are lazy and idle officers in the poor-law service, can they not be removed after due inquiry? Could not idlers and incompetents be removed from the sanitary service in the same way? The sooner the black sheep are removed, the better for the service and for the country. But to permit a sword to be held over the heads of conscientious workers is, in my opinion, unwise and impolitic in the extreme. The only shadow of excuse that one can call to mind for allowing a continuance of this injustice, is the fact that local government is "in the air," and that, since the whole service is to be re-constituted and re-modelled, it is not worth while to meddle with any particular part of it till the grand scheme, which has been talked of so long, is unearthed from its pigeon-hole at the office of the Central Authority. Whatever may be the reason for this continued neglect of our just demands, it is high time that medical officers of health should unite in self-defence, to protect their brethren and themselves from unjust treatment; to prevent able and deserving men from being driven from their appointments for doing their duty too well; to prevent combined sanitary districts from crumbling to pieces; and to

prevent injury to those able men who have given up good practices to labour for the well being of their localities. Shall we not be heard by reason of our importunities ? Can we not once more try the effect of a powerful deputation to wait on the present President of the Local Government Board, with a memorial, embodying our reasonable demands ? It is strange the apathy and neglect with which politicians of every party treat the public claims of sanitation. It cannot be made a political lever to help any particular party, and this I fear is the reason that they all turn a deaf ear to our representations. Governments say they have enough to do nowadays to keep themselves in office, without troubling with difficult and unpopular problems such as sanitary reform. Their motto evidently is, " Let us eat and drink, for to-morrow we die " (or go out of office). We need more sanitarians in parliament to educate and enlighten our legislators in this special subject. Our demands, if granted, would not only satisfy us, but would give a great impetus to our life-saving work. How can sanitary progress move forward if the great body of workers are discouraged and discontented ? The solution of many of the great social questions of the day depends, in a great measure, on the health and happiness of the masses. Without comfort and contentment, there is always danger of revolution and rebellion against authority. Bad health often leads to poverty, vice, and crime.

The sanitary service has received as yet very little encouragement from the State. We do not at present ask for honours or rewards, although some of our brethren have well deserved them. We ask that an unjust and unwise system should be altered, so that the work of the health officer may be carried on in peace. We ask that in all future schemes of local government, the appointment of medical officer of health may be taken from the local control of petty agitators, who do not recognise the utility or importance of sanitary measures. We ask to have the election to this office freed from the influence of all party prejudice. We ask that all sanitary authorities be kept up to a certain definite standard of efficiency, and that the present system be abolished, where one district is well looked after, and the next one to it neglected, to the serious danger and detriment of its neighbours. For, after all, the sanitary condition of each district does not alone concern itself or the locality in which it stands, but it may be a source of danger to the nation, by acting as a focus of infection to foster and disseminate disease to the rest of the country. It is evident, then, that it is of national importance that every district should be well cared for and kept up to a given standard of healthiness. To attain this it appears that there must be an inspection, by

representatives of the central authority, of the work done, and part of the grants given in aid of local expenditure might be made conditional on a satisfactory report being given. To do this would necessitate an increase in the number of the medical inspectors of the Local Government Board. This increase in the staff would create expense, and much opposition would doubtless be excited. But if the Government of the country could only become impressed with the fact that this money was needed for a national defence against disease and premature death, the necessary vote would be obtained. There appears to be very little difficulty in getting money for expeditions to the Nile or to the North Pole; why, then, should the nation grumble at a vote which would confer upon it such enormous advantages. The present undermanned and overworked staff of government medical inspectors could be doubled without entirely overtaking the work. The extra expense would be returned to the nation in the increased efficiency of the sanitary work throughout the land. The wage-earning classes would obtain a larger fund of health and strength, which is their wealth and capital. The rate-paying classes would have less to pay for paupers and police. Efficiency and economy would go hand in hand. Will not the country and its rulers recognize sanitary workers as patriots, striving for the welfare of every citizen, and not for their own gain or glory? These efforts not only save the country from much avoidable sorrow and suffering, but also conduce towards prosperity and peace. If this be so, do not these workers deserve some consideration from the State? It is the lot of all great movements, meant for the benefit of mankind, that they must pass through periods of trial and persecution before they arrive at any pitch of perfection. Sanitary science has had its martyrs, who have lost in its service life, or health, or livelihood. But now we trust the persecution period is past, and that the golden age of preventive medicine is dawning, when the apostles and teachers of sanitation will be regarded as the benefactors of the nation. In that case the medical officers of health of the future may hope to fare far better than their representatives of the present day have done.

Dr. Vernon (Southport) considered that the duties of Medical Officers of Health did not require much special training, and that general practitioners were perfectly able to undertake the duties, and that no certificates of efficiency were necessary or required. He held that practising medical men were in touch with the population, and were, therefore, proper persons to have the duties entrusted to them.

Dr. Britton (Harrogate), speaking from experience, considered that no local practitioner could undertake the duties of Medical Officer of Health and carry on his practice. He considered the Medical Officer of Health should have more support from the central authority than he usually received in matters where he came into collision with the local authority. He maintained that the office would be worth more, and good men would be retained in the sanitary service if its tenure were made more secure; whereas at present all the best men were being driven out and replaced by inferior ones at lower salaries.

Mr. S. W. North (York), speaking from an experience of twelve years as the Medical Officer of Health of York, contended that it was not for the public advantage to exclude men engaged in private practice from holding the appointment of Officer of Health. He considered it more important for Medical Officers of Health to have acquaintance with municipal affairs than to hold certificates in sanitary science.

Dr. Goldie (Leeds), speaking from an experience of fourteen years, said he felt it was impossible that the two positions of Medical Officer of Health and of a private practitioner could be properly combined.

Mr. H. E. Armstrong (Newcastle), considered that, as a rule, there should be a regular curriculum of teaching for those who were candidates for appointments as Medical Officers of Health, and diplomas given on proved efficiency in the subjects taught. He pointed out that this teaching was being carried out in some of the universities. The University of Durham had just instituted a license in sanitary science to medical men, after a course of special study in their College of Medicine at Newcastle-upon-Tyne. This qualification would be registrable.

Mr. Washington Lyon (London), as a London vestryman (Camberwell), deprecated the idea of the Local Government Board interfering with the local boards and their appointments, as suggested by some.

Several speakers informed Mr. Lyon that it was very common for guardians of urban districts to have these appointments in their hands.

Dr. J. W. Taylor (Scarborough) held that the Medical Officer of Health should not be severed from his private practice, inasmuch as if he gave up his practice he would be dependent upon a broken reed in supposing that the Local Government Board would support him in his appointment while he did his duty. At the same time he quite agreed in the *principle* of Medical Officers of Health devoting the whole of their time to the duties of the office; but their tenure of appointment must be fixed on a sounder basis than at present.

The Chairman, Prof. F. de Chaumont, agreed with the opinion of those who held that the duties of medical officers of health were incompatible with private practice. He took exception to the views held by Dr. Vernon and Mr. North with regard to medical officers of health not needing sanitary certificates. Their view seemed to be that it was unnecessary. In the case of those gentlemen there could be no doubt they were not required. He had now been an examiner for three Universities for a number of years, and although a considerable number of medical men who came up for examination in sanitary science passed with *éclat*, there were a good many who certainly did require certificates of competency. In that Capt. Galton, who had been his colleague at times, could bear him out. The Chairman agreed with Dr. Armstrong that it was advisable not only to have a certificate, but also a regular curriculum.

On "The Notification of Infectious Diseases," by Edward Seaton, M.D., Lond., F.R.C.P., Medical Officer of Health for Chelsea, Lecturer on Sanitary Science at St. Thomas's Hospital.

In deputing me to open a discussion at this Conference upon the important subject of the Notification of Infectious Diseases, you have doubtless been influenced by the consideration that Nottingham, for which town I was formerly Medical Officer of Health, was one of the first of the large provincial towns which followed the example of Bolton, and which obtained statutory powers requiring the notification of infectious diseases, and that I was among those who took an active part in promoting the adoption of this measure. Having learnt by experience that the medico-sanitary subject we are now about to discuss is complicated by many difficulties, I am anxious to treat it in as careful and impartial a manner as possible, though I am fully conscious of my own inability to do it justice. It may however be interesting to you to hear the observations of one who has paid attention to the subject for several years, and I myself shall have the satisfaction of knowing that however imperfect may be my method of treating it in my opening remarks, ample amends will be made by the exhaustive and instructive discussion which they are sure to give rise to, and which I hope will be shared in by those who, like myself, have had practical experience in the work of Urban Sanitation.

I will not occupy your time by re-capitulating the reasons

which are usually advanced in favour of making known the existence of infectious disease to sanitary authorities. They are based upon the dangers which are known to result from the secrecy which is frequently maintained with regard to the existence of contagious diseases. In such an assembly as this it would be quite as superfluous to argue in favour of the principle of notification as to adduce reasons for the establishment of Public Sanitary Authorities, or the appointment of Medical Officers of Health. We, as officers connected especially with the preventive side of medical work, have urged the importance of systematic notification. In so doing we have been, and are now, supported by the main body of the profession. There are indeed some medical men who argue against the desirability of any kind of notification, but they form only a very small section of the main body of the profession, to whose opinion upon questions connected with the preservation of health the public is accustomed to look for guidance. But the medical profession declines to do more than sanction the abstract proposition that notification is desirable. In proposing a practical measure for its adoption, the questions immediately arise—Who is to notify? to whom is the notification to be made? what is to happen when notification is made? Upon these points medical practitioners and medical officers of health have much to say. The prevailing opinion among ourselves is that reliable and systematic notification can only be secured by statutory obligations imposed upon medical practitioners. On the other hand, the profession generally declares that it is only necessary to impose statutory obligations upon the householder. Local acts have been opposed because they impose statutory obligations upon medical practitioners. The practical difficulties connected with notification are represented as formidable, and the advantages of compulsory notification are directly called in question. As a result of the opposition, no progress seems to have been made of late in putting the principle of notification into practical operation.

In approaching the subject at present it is desirable to begin by asking, What are the advantages actually derived from compulsory notification? and then to consider the practical difficulties arising from notification; after which little need be said on the question of statutory obligations.

What are the advantages derived from notification? Notification is only a means to the end. It is an essential part of the machinery for the prevention and control of certain infectious diseases which experience has shown to be amenable to control. Unless there is in existence a proper sanitary service, but little good can be derived from notification, and statutory

powers for its enforcement cannot reasonably be required. It is necessary to make this statement very clearly and emphatically at the outset, for I believe that much of the opposition to notification is based upon the knowledge that in many towns and districts there is no efficient sanitary organization. In a town, parish, union, or sanitary district, the representatives of the ratepayers may be ignorant or prejudiced men—perhaps influenced by notions of supposed self-interest—who have no desire whatever to promote sanitary work. An authority largely composed of such members may appoint as inspectors to carry out the Sanitary Acts incompetent men who have failed in other occupations, and who consult the wishes of their employers as well as their own by doing as little work as possible. In such a district there may be no hospital accommodation or machinery for controlling contagious diseases, and the medical officer of health may be a hard-worked general practitioner, who is paid some trifling sum to enable the authority to say that it has complied with the law, which requires such an appointment to be made. Now I apprehend we should all agree that under such circumstances very little, if any, advantage could be derived from notification.

In the metropolis there are special difficulties in the way of forming an effective sanitary service, arising from the absence of a central sanitary administration. I need not describe here the kind of service which exists in most of the large provincial towns, and which is so effective in the control of small-pox and other contagious diseases. It has not inaptly been compared to a service for fire extinction in large cities. Nothing of the kind exists in London, and it would be difficult to form an effective organization without some radical change in the constitution of its authorities. The masterly system of dealing with contagious disease in some of the large provincial towns is in striking contrast to the comparatively aimless method of procedure in London. You are no doubt aware that there are forty parishes or districts for London, and that each of these has its separate authority, and that there is no sanitary authority for London as a whole, in the sense that Glasgow, Liverpool, Manchester, or Birmingham has an authority. The sanitary work of the vestries, like that of the town councils, includes the suppression and removal of nuisances injurious to health, the supervision of food supplies, &c. In these important departments of sanitary work it is recognized that excellent work is being done; and we, whose public duties are in the metropolis, could not admit that in these respects the Sanitary Acts are less efficiently administered than in the best of the provincial towns. But in dealing with diseases which are contagious and in which both

unity and uniformity of action are required, the vestries are necessarily at an immense disadvantage. The Metropolitan Asylums Board was made the authority some years ago for providing and maintaining hospitals for the infectious diseases. This Board includes gentlemen of high administrative ability. As far as the provision of hospitals is concerned, this has been, as you are aware, carried out on a very extensive scale and at a very heavy cost: but so far as the prevention of epidemics of small-pox is concerned the action of the Board, which is composed of representatives of the Poor Law, and not of the Sanitary Authorities, has been attended with a lamentable want of success. Indeed of late years the excessive amount of small-pox has been quite a scandal to the sanitary organization of the metropolis.

The advantages of a good sanitary organization with compulsory notification is strikingly illustrated by comparison of some of the large provincial towns with London, in respect of the mortality from this one disease, small-pox. In a report which I have lately made to the Chelsea Vestry, I have published the statistics of small-pox mortality in London and the large towns of England during the last six years. The average yearly mortality for London per 100,000 of the population is twenty-six (the deaths at Darenth and the hospital ships occurring in 1884-1885 being taken into account). This far exceeds the rate of mortality in most of the large provincial towns, showing that a good sanitary organization alone—as at Birmingham—without compulsory notification, is a great safeguard against the spread of small-pox. But in some of the towns the mortality has been but a very small fraction of that in the metropolis, and Leicester presents a most remarkably favourable return. The death-rate in that town from small-pox would appear to be at zero, but a slight correction has to be made for the deaths which have taken place among the cases removed to the Isolation Hospital, which it so happens is just outside the limits of the Borough. The rate of mortality of that town compared with London is as one to twenty-six.

To me it appears that the experience of Leicester affords striking proof of the advantages of notification with a good sanitary organization.

Notification, combined with a good sanitary service, has limited the centres of infection. The infected persons have been secluded as speedily and completely as possible. By means of vaccination and re-vaccination all who are brought immediately within the sphere and risk of small-pox are rendered insusceptible to the disease. Leicester is a town which has become notorious of late years by its opposition

to the vaccination laws. Sooner or later the defences against small-pox may break down, and the probabilities are that a very heavy mortality will ensue as the consequences of neglect of primary vaccination. But if, in the future, the town should suffer from a severe epidemic, it will not furnish an argument against notification, it will only illustrate the folly of the people in having neglected primary vaccination. It cannot be too widely known that it is to vaccination that Leicester chiefly owes its protection from small-pox. The seclusion or isolation of the sick may be as complete as possible, but there are nurses and others who must be exposed to infection, and unless they were protected some of them would fall ill and the centres of infection become multiplied and uncontrollable. It is the cordon of re-vaccinated persons that protects the town from small-pox. Without the cordon an epidemic would have arisen long ago. The experience of Leicester shows one of the great advantages of notification. It enables vaccination to be provided and adopted *when and where it is most required as a protection against small-pox.* If the same practice could be carried out in London, I believe much of the mortality from small-pox and a vast amount of expenditure would be saved.

This leads me to speak of other advantages derived from notification, which is useful for many purposes besides that of securing the isolation or seclusion of the sick. We know how much the spread of Typhus is controlled by the cleansing, purification, and ventilation of the dwelling in which it has appeared. Dr. Russell, of Glasgow, described, in a popular lecture some years ago, the sanitary measures adopted by the authorities in houses where typhus is reported. It is impossible to question the advantages that must ensue from the systematic notification of cases of this disease which come under medical notice in the towns where it prevails.

Enteric fever is a disease which all of us have to cope with. If a sanitary authority has appointed a skilled medical officer and a skilled surveyor or engineer, and if it has provided a staff of inspectors to act under their directions, the early notification of this preventible disease is necessarily of great advantage. By this means defects in the drainage of the dwelling are discovered, pollution of the water supply, and contamination or infection of the milk supply is immediately brought to notice, causes of disease are removed, and channels of infection are stopped at their source. I do not of course mean to imply that in towns where no systematic notification is in operation, preventive measures of this kind are not actively in progress. A vast amount of work has been promoted by medical officers of health of late years, and it has been accomplished in spite of

great difficulties and prejudice. A knowledge of the existence and habitats of disease is recognized to be of great assistance in promoting structural works for improved drainage and water supply. I have always found it much easier to secure the adoption of sanitary improvements where it has been possible to point to cases of illness resulting from sanitary defects. I doubt not that your experience is the same as my own, and if it be so, surely we, as medical officers, from our practical knowledge, are entitled to speak with great authority. The stoppage of epidemics traceable to polluted milk or water can only be accomplished by the help of early notification of the cases of illness.

Diphtheria outbreaks need also to be inquired into with reference to the milk supply, and the possibility of their origin in ways that may be preventible makes their notification necessary for sanitary purposes. Those who are of opinion that this disease is due to defective drainage, will be able to make use of their knowledge to promote improvements in house sanitation. Opportunities are also afforded by notification to advise measures of isolation, which is too frequently neglected in the case of this disease.

The evidence of the benefits derived from the notification of scarlet fever is not so apparent as that which relates to small-pox. In Leicester, where the authorities have been so successful in keeping off an epidemic of small-pox, the notification of scarlet fever does not appear to have produced any good result. As comparison has been made between Leicester and London in respect of small-pox mortality, it is only fair that comparison should also be made with respect to scarlet fever. Let us take the mortality of the five years (1876–80) and compare it with that of the last five years (1881–5). The latter period is included in the time during which notification has been in operation in Leicester, whereas in London there has been no systematic or compulsory notification. The rate of mortality per 100,000 is as follows :—

	Period, 1876–1880.	Period, 1881–1885.
Leicester ...	68 ...	69
London ...	62 ...	42

Thus in Leicester, with notification, there has been a rise in the mortality from scarlet fever of about 2 per cent., and in London, without notification, there has been a fall of 32 per cent. Dr. Johnston has written at length upon the prolonged prevalence

of scarlet fever in Leicester. He has taken four scarlet fever epidemic periods, 1, (1857—1859); 2, (1862—1864); 3, (1869—1871); 4, (1874—1877), for comparison in respect of mortality with the epidemic period No. 5 (1879—1882), which has occurred since notification commenced, and he shows that the 5th (notification) epidemic period compares favourably with the epidemic periods 1, 2 and 3, while the excess in the rate of mortality over that in the 4th period "is but fractional in amount." This excess may have been due to a particular quality of scarlet fever prevailing in the district during the last epidemic period, and without notification it might very likely have given rise to a much higher mortality. Still, the figures are disappointing as regards Leicester. This is also the case at Warrington, which deserves particular notice on account of the stringent powers for the compulsory isolation by removal to hospital of persons suffering from scarlet fever, which were obtained at the same time as the notification powers. Mr. Gornall, in his 1882 report, points out that complete stamping out of such a disease cannot be immediately expected as the result of notification. In the account given in the "Practitioner" for 1884 of the Results of the Notification of Infectious Diseases, the following passage occurs :—

"The subject of the continued prevalence of scarlet fever in Warrington, notwithstanding the notification and the hospital provision, is dealt with in Dr. Thorne Thorne's Government Report on the Use and Influence of Hospitals for Infectious Diseases; and coupling the statistics there given with those since published, it would appear that notification with isolation had checked so rapid a growth of the disease as had been experienced in some former years, but that a very large total mortality still tended to spread itself over a series of years. The experience available is however too limited to warrant any final inference being drawn."—*Practitioner*, 1884.

The last sentence of the above quotation indicates the difficulty in arriving at any satisfactory conclusion with regard to the beneficial results of notifications in the case of scarlet fever. The Local Acts have been in operation a comparatively short time, and the amount of available experience is consequently very limited. Nevertheless, we may learn something from that experience. During the last ten years there has been a general decline in the scarlet fever death-rate. Amongst the twenty large towns, with regard to which statistics of mortality from scarlet fever have been tabulated by the Registrar-General, there are nine "notification" towns and eleven "non-notification" towns. Out of the nine notification towns, seven have showed a decline in the scarlet fever death-rate. Out of the

eleven non-notification towns, eight have showed a decline in the scarlet fever death-rate. But of the two exceptions amongst the notification towns, one is Leicester, to which I have already referred, and the other is Nottingham. In the latter town notification was only commenced in the middle of 1882, and therefore it belongs as much to the list of non-notification as to that of notification towns. Indeed, if the statistics of Nottingham are examined closely they appear to be very much in favour of notification. Dr. Whitelegge has devoted a considerable portion of the Annual Health Report for 1885 to a consideration of the results of notification in that town, and I reproduce the portion of his report which refers to scarlet fever.

"Scarlet Fever," (from Table Q.)

	Deaths.	Known cases.	Rates of known cases to deaths.
1878.	72		
1879.	180		
1880.	134		
1881.	353		
1882.	280	1029	3·7
1883.	59	428	7·3
1884.	37	384	10·4
1885.	31	390	12·6

"As far as the evidence to be derived from these figures goes, compulsory notification has been followed by a decided, and up to the present time lasting, reduction of mortality from the disease in point. In endeavouring to ascertain how far this reduction was due directly or indirectly to notification, it must be remembered that scarlet fever was epidemic in 1881-2, and that the death-rate from scarlet fever is steadily declining in England. The experience of previous years also shows that scarlet fever becomes epidemic every few years, while it always contributes its quota to the annual mortality even in non-epidemic years. Quite apart from any new system of prevention it was to be anticipated that scarlet fever would for a time decline in fatality to its usual level in non-epidemic years, or somewhat below it, seeing that every decennium shows a diminished scarlet fever death-rate.

"Making due allowance for these considerations, we have the following reasons for attributing to the system of notification an important part in the result.

1. "The decline commences with the commencement of compulsory notification. The consideration suggested above with regard to scarlet fever, viz., that it may have been taken at the crest of an epidemic wave, does not hold good in the case of enteric fever, which had been slowly gaining ground for several years previously, without any special epidemic.

"2. The decline is continuous. In scarlet fever we have an uninterrupted fall for four years, the notifications meanwhile becoming more and more numerous in proportion to the deaths —that is, the system has gradually come into full operation.

"3. The decline is not merely to the usual level of non-epidemic years, but to a point considerably below it.

"4. The decline in the scarlet fever mortality is greater than can be accounted for by the general diminution throughout the country. The death-rate from scarlet fever in 1885 was in Nottingham 0·13 per 1000, and in 28 large towns 0·24."—*Nottingham Annual Health Report*, 1885.

I think, therefore, there is good reason for transferring Nottingham to the list of notification towns, which show evidence in favour of the system as regards scarlet fever. This leaves only one town out of nine in which a rise of the death-rate from scarlet fever has to be accounted for, and that town is Leicester, in which the increase has been only 2 per cent. On the other hand, out of the eleven non-notification towns there are three which show a rise. Brighton, to the extent of 5 per cent.; Leeds, 29 per cent.; and Hull, 315 per cent. Turning to the towns in which a decline of the scarlet fever death-rate has taken place, we find among the notification towns seven, or including Nottingham eight, out of nine, or 89 per cent.; among the non-notification towns with a much larger population eight out of eleven, or 73 per cent., so that here again the evidence is in favour of notification. But the most important point in the comparison is that the fall in the case of the notification towns is much more marked than among the non-notification towns. Amongst the former more than half have shown a decline of over 60 per cent.; amongst the latter only one out of eleven has shown so marked a decline.

As far as the evidence goes, I submit that it is in favour of notification.

TABLES showing the Decline and Rise of Scarlet Fever Death-rates in the Notification and the Non-notification Towns; the figures being taken from the Registrar-General's Official Returns at Somerset House.

Towns in which there has been a RISE *in the Death-rate.*

NOTIFICATION TOWNS.

	Mortality from Scarlet Fever per 100,000 persons living. Period 1876—80.	Period 1881—85.	Rise in the Death-rate.
Leicester	68	69	1 per cent.
Nottingham	62	79	27 „

NON-NOTIFICATION TOWNS.

	Mortality from Scarlet Fever per 100,000 persons living. Period 1876—80.	Period 1881—85.	Rise in the Death-rate.
Brighton	38	40	5 per cent.
Leeds	77	99	29 „
Hull	34	141	315 „

Towns in which there has been a DECLINE *in the Death-rate.*

NOTIFICATION TOWNS.

	Mortality from Scarlet Fever per 100,000 persons living. Period 1876—80.	Period 1881—85.	Decline in the Death-rate.
Salford	119	46	61 per cent.
Portsmouth	86	15	83 „
Norwich	86	19	78 „
Manchester	100	42	58 „
Oldham	130	37	72 „
Bradford	89	31	65 „
Newcastle	107	65	39 „

NON-NOTIFICATION TOWNS.

	Mortality from Scarlet Fever per 100,000 persons living.		Decline in the Death-rate.
	Period 1876—80.	Period 1881—85.	
London	62	42	32 per cent.
Plymouth	32	6	81 ,,
Bristol	70	31	56 ,,
Wolverhampton	105	48	54 ,,
Birmingham	97	44	55 ,,
Liverpool	98	57	42 ,,
Sunderland	179	84	53 ,,
Sheffield	135	87	36 ,,

The benefits derived from the notification of this disease are not confined to the seclusion of the sick at hospitals. Formerly the disease was spread broadcast by the school attendance of children in the "peeling stage," by clothing, provision shops, and infected milk. Measures have been taken to check the spread of epidemics by these channels in all towns, but by means of notification they have probably been more effectual in some towns than others. In the evidence which I gave to the Liverpool Commission in 1882, I insisted upon the importance of compulsory notification as a means of checking the spread of scarlet-fever by compulsory school attendances. In the absence of a proper system of notification children may be compelled to attend school when they are in an infectious state.

In this City of York a most admirable system has been devised by Mr. North for immediately utilizing the information afforded by notification, and checking this fruitful source of the spread of the disease. The regulations which have been drawn up for this city will probably serve as a guide for many other towns. There is a general testimony that whenever notification has been adopted the work of disinfection has been largely increased. The study of scarlet-fever in relation to milk supplies has assumed great importance since the recent epidemic in Marylebone was traced by Dr. Wynter Blyth to an infective milk supply. If it is possible that a disease of the cow can give rise to scarlet fever, many outbreaks of the disease must be due to milk, and for the purpose of investigating this question notification to a proper authority is required.

I must not dwell any longer in these opening remarks upon the benefits derived from notification when a good sanitary service is provided. I should like to have referred to the collateral advantages to medical knowledge derived from notification, and

I may specially mention the useful returns which are given every month in the "Sanitary Record." Considerations of time, however, warn me that I must proceed at once to a discussion of the difficulties attending systematic Compulsory Notification. That there are serious difficulties is not to be denied; if it were not so the main body of the profession would not oppose the promotion of Local Acts. At the same time it must be specially mentioned that in towns where notification is in operation the difficulties that were anticipated have been successfully grappled with, and that after the first friction has been overcome the Acts seem to have worked smoothly enough. Nevertheless, the difficulties exist, and it is better they should be fully recognized by ourselves and understood by the public.

Here let me say that in my own case these difficulties were made light and trivial, because I always felt that I had the firm and steady support of the Health Committee that I served at Nottingham. This Board was presided over by my kind and good friend Mr. Alderman Ford, a gentleman who personally knew the risks and inconveniences entailed by work amongst infectious diseases; and who still, now in the evening of his life, continues at his post of danger and responsibility.

The first difficulty arises from the anxiety which physicians and medical practitioners necessarily have for the interests of the individuals under their care—the patients for whose treatment and cure they are primarily responsible. The position of the main body of the profession is unassailable at this point. Whatever action the public interests may demand, it must be carried out with a tender regard for the safety and welfare of sick persons. If it is necessary that a person suffering from an infectious disease, such as small-pox, should be transported several miles into the country, the long journey should be planned so as to involve the smallest possible amount of risk to the patient's recovery. If cases of infectious disease must, in the public interest, be removed to a hospital, proper and comfortable accommodation, medical attendance, food, and nursing should be provided. In many towns and districts the hospital accommodation is of a wretched character.

This leads me to speak of another difficulty which may be called "the hospital difficulty." I refer now to the fact that small-pox has been found to be most prevalent in the neighbourhood of the large London hospitals, and to the belief which is held by some high authorities, that this prevalence is due to the dissemination of the particulate matter of small-pox in the air. This has caused a most unreasonable fear of the dangers which may arise from an infectious hospital, and is one reason why

proper hospitals have not been provided. It is also one reason why authorities have been slow to move for powers of notification. But it has been shown that the experience of the country towns is altogether opposed to that of London, where, as I have already pointed out, the whole system of small-pox prevention is very imperfect. In the provinces it is not so difficult to obtain sites for hospitals at a distance from populous neighbourhoods. If there is a proper system for small-pox prevention by re-vaccination as well as isolation, large hospitals for this disease are not required, and there can be no appreciable danger from small hospitals situate outside the towns.

These difficulties which arise from the health interests of the public as well as of private individuals I place first. But there are other important difficulties arising from the business or trade interests of the community or of individuals.

We all know the reasons which led the authorities at Marseilles in 1884 to keep secret the existence of cholera in their town. It was the fear that their commercial interests would suffer. In France, the "ostrich policy" can be carried out even in the case of cholera. In this country public opinion is more advanced, and the concealment of Asiatic cholera would be impossible, though the existence of small-pox and other dangerous and infectious diseases in a town may be kept secret until they become known by the death returns. There is no reason for giving publicity to the existence of these diseases in a town if the community can be satisfied that efficient measures are taken for their prevention. But a desire to suppress the facts with regard to an initial outbreak of disease is generally accompanied by a neglect of effective action until all action is too late to be of use. In the case of private individuals, the difficulty arising from making public the existence of dangerous infectious disease is most conspicuous. A shopkeeper may be ruined by its having become known that he has cases of scarlet fever at his place of business; an artizan may be thrown out of employment for an indefinite time through his employer having been informed of the existence of a badly isolated case of small-pox at his house. In such cases a hardship is often inflicted upon individuals, and it is none the less a hardship on account of its being needful for the public good. This is one of the strongest motives to the concealment of disease, and it will never be overcome until the practical common sense of the people has provided a remedy. The Trades Union Congress which met at Nottingham, in 1883, passed a resolution in favour of notification, but coupled with the provision that compensation out of the rates should be afforded to those who were thrown out of employment in consequence of the existence of infectious disease in their households having been

made known. It is very doubtful whether this principle would ever be adopted, and it is still less likely that compensation would ever be paid to shopkeepers or those who lose business in consequence of the existence of infectious disease at their establishments becoming known. The proper remedy for this hardship arising from notification is by the establishment of the principle of insurance against loss or risk from infectious disease. Shopkeepers and others insure themselves against a pecuniary loss arising from fire. Why should they not also insure themselves against pecuniary loss arising from infectious diseases? The difficulty attending notification, to which I now refer, does not appear to have been found insuperable in the towns where the system is in operation. This no doubt is due to the extreme care and discretion of some medical officers who have been most desirous of making the notification a success, and who have exhibited an amount of thoughtful regard for the interests of shopkeepers which cannot always be expected. In other instances in which this difficulty does not appear to have assumed much prominence, I suspect that so great has been the regard for individual pecuniary interests by the authorities and their officers, that little or no action has followed upon the notification, and consequently much of the public good which should result from the system is lost.

The third difficulty to which it is necessary to allude is of a different kind to those as yet referred to. It affects us personally as medical officers of health, and I would therefore prefer to ignore it, if it were not that my paper would be obviously incomplete by the omission. It has already led to misunderstandings between private practitioners and those members of the profession who act as medical officers of health, the latter sometimes being placed in such a trying position that there is no wonder that they feel lukewarm in advocating a measure which must entail a vast amount of trouble and responsibility to themselves, and which may bring them into collision with those with whom they would most like to be on friendly terms. One of the sources of all this friction and irritation is the unsatisfactory nature of the appointments of medical officers of health. I am not now referring to the appointments for great cities, for counties, or parts of counties, in which sanitary districts have combined to appoint a medical officer of health. I allude now to the great majority of separate sanitary districts, the small boroughs, parishes, and unions in which the areas of local government are much too small to admit of satisfactory medical public health appointments being made. Here the choice often practically lies between the appointment of a junior member of the profession debarred

from private practice, and appointed upon the whole service system, or a member of the profession engaged in ordinary medical practice in the district. In either case there must frequently be prejudices and objections on the part of the private medical practitioners, which are not easily removed. On the one hand, there is a feeling amongst practitioners against being required, under penalty, to notify the existence of cases of infectious disease amongst their patients, to one who is much junior to them in the profession; on the other hand, there is a dislike to notifying cases to a "rival practitioner." I do not intend to open the question "whether it is desirable that medical officers should be debarred from practice," but I may observe that the Liverpool Commission, appointed to visit the towns where notification was in operation, appeared to be in favour of medical officers being engaged in the practice of their profession. You are also no doubt acquainted with Dr. Gairdner's views on this subject. On the other hand, the expressions of opinion which I heard from most of the speakers at the Worcester meeting of the British Medical Association, in 1882, were decidedly against the appointment of private practitioners as medical officers of health. The difficulties would be overcome if sanitary authorities would recognize the importance of combining together for the purpose of this appointment. It is a mistake to suppose that the duties of a medical officer of health require that he should be always on the spot. The "combination appointments" have as a rule worked exceedingly well, and the arrangement appears to be most satisfactory to employers as well as employed. But as long as sanitary districts remain separate, no general rule can be laid down for medical sanitary appointments; and if public opinion demands that notification of infectious disease should be made, medical practitioners and medical officers will have to reconcile these differences for the public good.

It remains only to consider very briefly who is the proper person to make the notification; should it be the householder or the medical attendant? Further, is it possible to rely upon voluntary notification by medical men for a fee, and thus avoid the objectionable penal clause?

If there is provided a good sanitary service for a district the authorities have a right to demand that notification should be as early and complete as possible. I believe that there is a decided opinion amongst us that notification by the householder is insufficient for the purpose. Greenock has tried the plan, and there it has failed. The Notification Clause, obtained for Nottingham in 1878, placed the statutory obligation to notify upon the householder, but this did not meet the objections of

the medical men. About two years after it was put in operation I had experience of its working, and during that time the notification almost always came direct from the medical man. So that it appears to me that the clause, which at one time had the approval of the British Medical Association, does not present any advantages over that which places the responsibility of notifying upon both the householder and the medical attendant —"the dual method," as it is called. This is the method which, we are informed, is approved of by the Local Government Board. A copy of the Manchester Provisional Order is given as an Appendix to the Report of the Board on the subject of Notification, and the terms of this order are held up as typical of those which sanitary authorities might most usefully adopt. The diseases included in that list are the following: small-pox, cholera, typhus, enteric, scarlet, relapsing, continued, and puerperal fever, scarlatina and diphtheria.

As to voluntary notification I need only quote the remarks of Dr. Hill, of Birmingham, the President of the Metropolitan Society of Medical Officers of Health, who thus expressed himself in an address which he gave at the Health Exhibition in 1884:

"The objection to voluntary notification is that it is incomplete and, as human nature is constituted, probably ever must be, but unless complete it is useless for the prevention of epidemics; it is only because of its incompleteness and, therefore, uselessness under the voluntary system, that it is necessary to resort to compulsion. The value of complete notification was well seen in Birmingham during the early days of the present visitation of small-pox. This disease is one which from its rarity and from the dread of it in the minds of the public is more likely to be spontaneously notified than any other ordinary zymotic; the consequence was that for many months the disease could get no footing in the town, because under the influence of fear every case was notified to me directly on its nature being made out; over many months 77 sporadic cases were reported, with the result that the disease was prevented spreading by means of isolation, disinfection, &c.; but in time cases occurred which were not reported, and then the disease, liberated from control, rapidly became epidemic; as long as every case was reported the epidemic was prevented, but no longer. The voluntary system answered for a time, but soon broke down, as it always will do, and as it always has done from time immemorial to the present. The experiment has been made so long that it is unnecessary to continue it; it has indeed lasted too long, and to continue it still is altogether unjustifiable. Of the nearly 300 practitioners in Birmingham only 113 have ever voluntarily notified. In saying this much, I do not mean that

these 113 have all notified in each year, but only last year. Nor is it to be understood that they have notified all their cases, but only such as they pleased, and probably only a small proportion; or that they have notified them early, when alone notification is of much value.

"Does any person believe that such a system of notification can achieve a real advantage in the way of protecting public health, or lead to any result except the waste of public money?

"The voluntary system answers very well in the case of cholera, because so great is the alarm and even horror excited by the disease, that it is practically compulsory; in other words, that result is effected by fear which is denied by reason. But in the case of a disease of which there is no fear, such as scarlet fever, although it is a thousand times more destructive to life, the voluntary system breaks down altogether. Instead of the medical man reporting every case of preventible disease, he reports only such as he chooses; he will report, for instance, the case of a domestic servant whose presence in a large and respectable family is considered objectionable, and whose removal is therefore desired, and she is removed to the hospital accordingly, but the next case he may for special but insufficient reasons decline to notify, although the danger to the public may be as great in the one case as in the other."—*Transactions Society Medical Officers of Health*, 1883-84.

In conclusion, I beg to submit to this conference that there is ample proof of the benefits derived from notification where there is a good sanitary service, but that without a good sanitary service the full advantages are not to be obtained. That the difficulties associated with notification are considerable, but that experience has shown that they are not insuperable.

[*For discussion on this paper see page* 161.]

On "Organisation and Administration for the control of Infectious Diseases," by JOHN F. J. SYKES, B.Sc. (Public Health), Medical Officer of Health for St. Pancras.

IN endeavouring to sketch the lines upon which, as far as our knowledge at present extends, we should proceed to prevent the spread of infectious diseases, I will commence by making it

clear how it is intended to deal with the subject, although I trust the title of the paper conveys as nearly as possible its limits. The hospital will be treated only from the point of view of isolation, but the details of construction and management will be beyond its scope, also the question of vaccination except in so far as it forms part of the system in allowing that efficient vaccination may reduce to a minimum the provision for small-pox accommodation. Further, the details of treatment and the precautions to be observed in infectious cases will not be touched upon, although the provision of nurses amongst the extreme poor, and the prohibition to drink fresh cows' milk in the raw state, may in the future, if adopted, materially control infectious disease.

In contra-distinction to the precautions which can only be advised in individual cases, those measures will rather be considered which with a proper organisation can be actually carried out in a systematic manner and on a comprehensive scale by the medical officer of health.

It would be well to commence by briefly considering the Infectious Diseases, then the materials for their control, the staff to deal with them, and lastly the method to be adopted.

In dealing with Infectious Diseases, man early recognized his powerlessness to combat them. He fled. Thus, in times of epidemic, cities were deserted, and from dread of returning many became ruins. Such fearful results can scarcely be realized in the present day. Under less influence of panic, and as man grew more civilized, instead of the healthy fleeing from the infectious sick, the sick were cast out as unclean. It remained for the present age to perfect a system of separation for protecting the healthy whilst tending and nursing the infectious sick, the system of isolation.

Thus we have passed through three stages:—

1. The healthy fleeing the sick.
2. Casting out the sick and more or less neglecting them.
3. Isolating and nursing the infectious sick.

So much for the development of organisation then as to purely medical treatment. In very early days also it was observed that one zymotic attack appeared to procure immunity from a future attack; this was the germ of idea for treatment which, commencing in ignorance, resulted in designedly avoiding to separate the children from the infectious sick, and even in putting them to sleep together, so that early in life they might contract the disease and procure future immunity, regardless of present consequences. I am not quite sure that the custom is entirely abandoned. (At the International Medical Congress at Amsterdam in 1879, the method was seriously advo-

cated for scarlet fever, and cases even quoted). Later, the more advanced and ingenuous people in the East, finding the system or want of system in the case of small-pox proved fatal or produced incurable affliction, conceived the idea of inoculating the disease, making sure of an attack under favourable circumstances and in a benign form. Compared to the former state, this system was wonderfully successful, but produced fresh centres of contagion, and occasionally untoward effects. Again, it has remained for this later era to discover the means of pursuing a system of inoculation which, whilst still affording protection, robs the disease—1stly, of its power of infection, and, 2ndly, of its power to kill, maim, or disfigure. This is vaccination. There is some hope that a like discovery may, before long, similarly protect us from Scarlatina.

Here again we have passed through three stages of protection by—

1stly, Contagion.
2ndly, Inoculation.
3rdly, Vaccination.

We are now armed with two powerful weapons, which promise to become yet more perfect, viz., vaccination and isolation. With isolation, we are at present more particularly concerned. The following, although not a complete list of all infectious diseases, are those with which we have more frequently and more especially to deal, excepting cholera.

Infectious Diseases.

Temporary Provision	Cholera	Special Epidemic Disease.
Hospitals	Small-pox	Major Infectious Diseases.
	Scarlatina	
	Typhoid Fever	
	Typhus "	
	Continued "	
	Diphtheria	
Homes.	Measles / Rötheln	Minor Infectious Diseases.
	Whooping Cough	
	Mumps	
	Chicken-pox	

All these diseases should with advantage be excluded from general hospitals, and come properly within the scope of isolation hospitals.

In order to clear the way cholera and the minor infectious

diseases may be first briefly referred to, and then the more important or major infectious diseases taken together, with suggestions as to isolation.

Cholera will demand such special arrangements and precautions, if unfortunately it should visit us, that to enter fully into them would require a monograph to itself. It is introduced here for the purpose of bringing out two points. Firstly, that whatever form of structure is adopted for the treatment of cholera patients, it should, contrary to what applies by general acceptance to fever hospitals, be in the midst of the infected area, for cholera is a rapid disease and the sufferers will not bear transit. Secondly, that buildings intended as fever or general hospitals should not be used for cholera patients.

The Minor Infectious Diseases are very destructive to infant life, extending into childhood and occasionally affecting adults. They are introduced partly to make the list more complete, and the relative position of infectious diseases clear at a glance, and partly to offer a suggestion. When the more serious infectious diseases have been brought under effectual control, possibly our humane feeling, or social welfare, will prompt the extension of some form of isolation as homes of refuge to sufferers from these diseases, amongst our poorer fellow-citizens, who do not possess the means of separation and of nursing, and so subject whole families to run the gauntlet of these maladies less dreaded but yet injurious, the first three often fatal. Of the nine principal zymotic diseases, two, viz., measles (German measles, or rötheln is classed with measles in the returns) and whooping cough are included amongst these minor infectious diseases. Diarrhœa, although one of the nine and liable to become epidemic under seasonable influences, is not strictly an infectious disease. It may be due to so many varied causes, that to treat the symptom—for such only diarrhœa is—of many different diseases in one hard and fast manner is neither necessary nor desirable.

The Major Infectious Diseases, which constitute the remaining six of the nine principal zymotic diseases, urgently demand measures for their control, and are those with which we are more immediately concerned.

Small-pox: There is no doubt that Small-pox Hospitals are a source of danger to the inmates of surrounding dwellings, without entering into the question whether the infection is transmitted aerially from the Hospital itself, or diffused by the transport, or whether it is spread by convalescents, the staff, or persons supplying the Hospital. Hence, Small-pox Hospitals should be removed from dwellings and not be too easily

accessible. If forming part of a complete Fever Hospital, the Small-pox building should be removed a convenient distance from the rest, and access restricted within narrow limits and rigidly supervised.

Scarlet Fever: The infection of Scarlet Fever, although not so far reaching as that of Small-pox, is nevertheless easily spread, and this disease would be more advisedly treated in a building separated somewhat from the general Fever Building, or in a separate wing.

The General Fevers: Under this head would come Typhoid, Typhus, and suspicious continued Fever. It is obviously desirable that Diphtheria should also come under this category, and relapsing fever, which is now of rare occurrence, may be classed with typhus. These might, with advantage, be treated in a single building, possibly in separate wards. This outline can be enlarged upon to any extent, but I confine myself to a minimum, for the sake of lucidity and brevity.

The complete institution would be constituted somewhat in this manner, and may be called a sanatorium or by some other soothing name, to allay the fears and prejudices of the public.

Sanatorium.

Hospital buildings.
- I. Small-pox building.
- II. Fever building:
  1. Scarlet fever wing.
  2. General fever wing.
     - Typhoid fever.
     - Typhus fever.
     - Continued fever.
     - Diphtheria, &c.

Administrative buildings.
- III. Residential building:
  - Staff, &c.
- IV. Service building:
  - Disinfecting chamber for hospital use.
  - Ambulance, &c.

Isolation of the whole hospital or sanatorium must have regard to two points: firstly, that it should be removed from dwellings, but not so far as to render transport unnecessarily long; secondly, that it should be out of the track of ordinary traffic; in fact, difficult of access to the public, and yet easily communicated with from the central office.

The first condition is not difficult to comply with, but the second involves a paradox, for if it be difficult of access to the

public, it must be equally difficult for the central authority to communicate with. Another modern introduction renders this possible, which would have been worked with difficulty only a few years back. I refer to the telephone, which, firstly, allows the hospital to be isolated more effectually, since communication can be maintained with facility; secondly, facilitates enquiries by patients' friends, renders visits and exposure of officials from the sanitary department unnecessary, and reduces to a minimum the occasion for resident officials to quit the hospital except on leave, when a regular system of disinfection can be adopted; and, thirdly, requires no skilled labour, is rapid in its action, and in larger towns, forming part of a general system, the instrument can be used for general purposes, and in smaller towns to hold communication with outlying districts and townships—additional encouragement for local authorities to adopt it. The highly organised system of the Metropolitan Asylums Board owes much to the telephone, and I venture to doubt if it would work as efficiently without it. The central circuit would be more complete if all the hospitals, &c., were in communication with the central office of the Board, and the secondary circuit should be completed by all the London parishes through the central telephone office being placed in communication with the central office of the Board, instead of scarcely one-half of them as at present.

The main point, therefore, to be considered, is to isolate the hospital as much as possible. The best positions for isolation, if available, are either upon a hill or upon a ship or an island, or on the other side of a water-way, just beyond the town. Thus unsightly and repellent brick walls may be wholly or in part dispensed with to secure isolation, and, at the same time, the distance of transport may be reduced. The open sea-coast is of no advantage for site. A town may be placed under three different circumstances:—

1. With a water-way which would enable it to isolate—
    (*a*) A floating hospital upon a harbour or river;
    (*b*) A land hospital upon an island or opposite shore.
2. With a hill.
3. Without either.

In the last instance there is no choice, and the hospital could not be placed so close to the town with impunity as in the two former cases. Water carriage as well as land transport would be necessary for a floating hospital, an advantage to a number of townships upon a river, but to a hospital upon an island or upon the opposite shore a ferry could transport the ambulance without disturbing the patient.

I have dwelt upon the hospital because without it any system

of control is incomplete, and also in order to draw attention to the advantages of the position of a town being turned to account for isolation. The 131st Section of the Public Health Act should have made hospital provision compulsory, not permissive. Medical officers of health should urge this question upon their sanitary authorities, and not wait till times of panic to obtain a hasty temporary erection ready just in time to be too late.

Supposing that the authority is public-spirited enough to have availed itself of permissive clauses, and possesses an infectious hospital with an ambulance, in telephonic communication with the central office, a public disinfecting apparatus, and a public mortuary for infectious cases, how will the system work?

The well-to-do, and those who possess facilities for proper isolation and nursing, will care for themselves. There is a large class who are not well-to-do, not even comfortably housed, and yet not absolutely paupers; but take as example a pauper infectious case, because it simplifies the points and omits the financial question.

The relieving officer gives an order for medical attendance, the district medical officer finds the case can only be treated under difficulties, and may become a possible centre of infection. To relieve himself—and rightly so—of the onus attaching to improper nursing and the spread of contagion, he notifies the case to the medical officer of health, but he is not bound to do so. The patient is willing to go to hospital, from the central office the ambulance is "called," the patient is removed to hospital, and the arrival is "called" back to the central office. The sanitary inspector makes enquiries, and inspects the sanitary arrangements of the infected house. The disinfector (who may also be the sanitary inspector) disinfects the room, and removes the infected articles to the apparatus, disinfects them and returns them, or burns them.

In such a case all goes smoothly, but it will break down if, firstly, the medical attendant does not notify to the medical officer of health; secondly, the patient refuses isolation. The first involves the question of notification of infectious diseases, and the second the power of removal.

To briefly put the question of notification. It is the primary duty of a medical officer of health to protect the community against an epidemic of infectious disease, that duty obviously cannot be carried out unless he is informed betimes of its presence. How does notification enable the medical officer of health to do this duty to the public?

1. By watching the approach of an epidemic, to make timely provision.

2. By ascertaining the cause of the epidemic, to prevent its continuance or its recurrence.
3. By disinfecting, to prevent the house, etc., being a constant source of infection.
4. By removing those patients certified by the medical attendant to be without proper nursing or isolation, in order to prevent them becoming centres of infection.

What are the objections raised to notification? It will be observed that they overlook the first two and most important objects above mentioned.

They are briefly that it:—

1. Disturbs the relations of doctor and patient.
2. Leads to concealment.
3. Disturbs the relations of medical attendant and medical officer of health.
4. Does not diminish infectious disease.
5. Is liable to lead to unnecessary removal of patients.

We must remember that the medical attendant's first duty is to his patient, his next to the patient's family, but the public comes last, and that the duties of a medical officer of health are in the reverse order.

By whom should the notification be made? I am inclined to put it in this manner: a certificate of the cause of sickness to be given by the medical attendant, in the same manner as a certificate of the cause of death, to the nearest relative, friend, or person in charge. That person, in like manner, to be held responsible for ascertaining the cause of sickness and for giving information if infectious, by sending in a medical certificate to the proper authority.

In answer to the objections raised:

1. I fail to see that a certificate of sickness would have any more effect upon the relationship of doctor and patient than a certificate of death.

2. Nor can I conceive how it would be any the more likely to lead to concealment than in the case of death, if placed under similar conditions. The rectification of sanitary surroundings and disinfection confers a benefit on the family and the community, which by right-minded persons is sought after rather than avoided by concealment, and the medical attendant is relieved from the responsibility of improper disinfection performed by incompetent persons.

3. It is no part of a medical officer of health's duty to visit the cases of infectious disease reported to him by a medical man already in attendance, unless requested to do so or special circumstances should arise. Therefore there can be no cause

for friction between the medical officer of health and his professional brethren.

4. That notification should have only a trifling effect in diminishing endemic infectious disease seems probable, from the accounts of the thirty-eight or thirty-nine towns that have adopted it in a compulsory form. But it should be remembered that the object of notification is not so much to annihilate infectious disease as to prevent endemic infectious disease from becoming epidemic, and to enable us to control it before, and not after it has assumed epidemic proportions. We are not so utopian as to expect to eradicate infectious disease in a twinkling.

5. As to removal, it is only advocated in those cases which can be no credit nor profit to the medical attendant. His certificate would convey the necessity or not for removal. One advantage must be added—the moral effect of the duty falling upon the medical attendant to represent that removal may be necessary, if nursing and isolation cannot be carried out according to instructions, would strengthen his hands immensely in obtaining proper treatment for his patients. Unnecessary removals by a medical officer of health would soon procure a fatal unpopularity. That brings us to the question, *when is removal necessary?*

It will be agreed that no infectious case should be allowed to remain in any public institution where it cannot be efficiently isolated. I believe also that the medical profession has accepted the following aphorisms. Firstly, children coming into contact with an infectious case should be withheld from school; secondly, adults coming into such contact should be withheld from workshop, factory, or offices; and thirdly, clothing or food should not be allowed to issue from premises where it is liable to have become infected. In the case of children no harm is done, but in the case of adults this arrest of occupation is a vital matter.

Three methods of isolation are open to us for preventing the spread of infection :—

1. Removing the infectious case from the healthy.
2. Removing the healthy from the infected.
3. Boycotting the family or household.

The third course is the logical result of acting upon the aphorisms above quoted; it is also the course recommended by the Privy Council in the case of dairies, etc.; you may stop the sale of milk, but you cannot remove the infected milkmaid. It may be of indirect assistance in promoting removal, and possibly the legislature prefers this indirect pressure, but compulsory arrest of persons' occupations by closing workshop,

factory, office, or any other workplace against them is ruinous and iniquitous, unless compensation be allowed. Local bodies are not given to generosity, and compulsory compensation would lead to endless difficulties.

The second course may be adopted under better circumstances by the healthy betaking themselves betimes elsewhere.

The first course, namely, removing the case to hospital, is the kindest one to adopt under these circumstances.

But you have, what occurs now and again, an obstinate employer or employé that refuses removal; this brings us to the question of compulsion, and without this power as a last resort in exceptional cases the control is incomplete.

The power of compulsory removal is looked upon as a horrible bogey, but it is not at all terrible if looked at in an unprejudiced light. Patients are very willing to go to hospital, and it is very rarely necessary to exercise such power. Dr. Littlejohn reported of Edinburgh in 1882, that there were 7063 notifications, that £882 17s. 6d. was paid in fees, and that in not one of the instances was it necessary to use the compulsory powers possessed for the removal of patients.

Similarly, Dr. Thorne reported to the Local Government Board in 1880, the rare necessity for compulsory removal.

But that it should be only occasionally necessary is no reason for obstructing or encumbering it with formalities which may cause serious delay in an urgent case. It is true that by Section 142 of the Public Health Act the infectious dead may be removed to a mortuary by order of a Justice, and by Section 124 an infectious case without proper accommodation or in a room occupied by more than one family, or upon a vessel, may also be removed by order of a Justice. But what is "proper accommodation?" Observe the standard by which it is gauged by the legislature, and upon which the Justice founds his opinion "several families occupying one room." Do all Justices readily accede to the plea "Salus populi suprema lex?"

The only power left to the sanitary authority is the power to remove a case from a common lodging-house. Was the legislature afraid that the sanitary authority would exceed its powers in sanitary matters? This is not borne out by experience.

You may directly ruin a milkman or an inn or lodging-house keeper, and indirectly many others, through their employers, but you cannot compel removal of the infectious case.

The legislative misconception that encourages obstinate persons in their own ruin, and frequently in the ruin of others, for the public good, is incredible; space will not allow the quotation of instances.

Let us have the lesser of the two evils, viz., the power of compulsory removal.

One other point: means are amply provided to prevent the spreading of infection by the person or clothing of the sick by exposure in public, in Section 126 of the Public Health Act, or by public conveyance in Section 127, or by public lodging in Section 128. I have not considered it necessary to mention in this paper the corresponding clauses of the Sanitary Act of 1866.

In conclusion, this condensed account of the principles underlying the bases of the system for the control of infectious disease will, I trust, demonstrate :—

Firstly.—That every sanitary authority should possess an infectious hospital and the necessary appurtenances.

Secondly.—That all cases of infectious disease should be notified to the authority.

Thirdly.—That the power of compulsory removal should be amended, and transferred from the magistrate to the sanitary authority, with power of appeal to the magistrate in case of refusal or obstruction.

Local efforts have achieved something, but the time has now come when the duties of sanitary authorities in the control of infectious disease should be systematized and extended compulsorily to all urban and rural districts by a general act of the legislature.

[*For discussion on this paper see page* 161.]

On "Hospitals for Infectious Cases—should they be free, or a charge made for maintenance?" by Francis Vacher, F.R.C.S., F.C.S.

In the Public Health Act, 1875, some previously existing powers relating to hospitals for infectious diseases were re-enacted, and additional powers with the object of preventing the spread of infectious cases provided. The previously existing powers I refer to were mainly in the Sanitary Act, 1866; and prior to the framing of this measure, very little accommodation for patients suffering from infectious diseases was furnished, except as the result of private charitable effort. Most of the hospitals for infectious diseases throughout the

country, the utility of which is now universally recognised, are the outcome of the Public Health Act, 1875; and any increased accommodation about to be provided by local authorities will probably be under powers conferred by this Act. I propose, then, to open the discussion of the question which has been selected, by referring to this enactment. The exact terms of the powers of local authorities to provide hospitals are in Section 131; and exact terms of the power to recover cost of maintenance of patients in hospital are in Section 132.

131. Any local authority may provide for the use of the inhabitants of their district hospitals or temporary places for the reception of the sick, and for that purpose may:—

Themselves build such hospitals or places of reception; or,

Contract for the use of any such hospital, or part of a hospital, or place of reception, or,

Enter into any agreement with any person having the management of any hospital, for the reception of the sick inhabitants of their district, on payment of such annual or other sum as may be agreed on.

Two or more local authorities may combine in providing a common hospital.

132. Any expenses incurred by a local authority in maintaining in a hospital, or in a temporary place for the reception of the sick (whether or not belonging to such authority), a patient who is not a pauper, shall be deemed to be a debt due from such patient to the local authority, and may be recovered from him at any time within six months after his discharge from such hospital or place of reception, or from his estate in the event of his dying in such hospital or place.

Thus it is plain that a local authority may alone, or jointly with another local authority, or more than one, do three things:—

1. Build a hospital.
2. Contract for the use of a hospital, or part of one.
3. Contract with hospital management for maintenance and treatment of sick inhabitants of the authority's district.

Any local authority may make provision in one or all of these three ways, or they may do what was done in 1875 by the authority I serve—alter and adapt houses for the purposes of a hospital. It is interesting also to note that in the section of the Public Health Act quoted, and in the corresponding section (37, I believe,) of the Sanitary Act, 1866, the inhabitants for whom provision may be made are simply "the sick." If the term "infectious sick" had been used, disputes might have arisen as to whether patients suffering from typhoid

fever, cholera, pneumonia, &c., could be properly received into a local authority's hospital. As regards the expression "may," in the section quoted, it has been the subject of much debate, but there is no doubt the powers here given were meant to be used, and that local authorities *are under an obligation* to provide hospital accommodation. The old sewer authority acquired the rights possessed by Local Boards of Health under the Sewage Utilization Act, 1865, and in the following year the sewer authorities were responsible for making hospital provision in the provinces, just as their successors, the local authorities, are now. Still, the word "may" is not synonymous with "must," and local authorities, not making hospital provision for their sick, are not subject to pains and penalties, and cannot be fined and coerced.

The section providing for the recovery of cost of maintenance of patients in hospital is very explicit and complete. Any expenses incurred by a local authority in maintaining in hospital, &c., a patient who is not a pauper, shall be deemed to be a debt due from such patient, and may be recovered within six months after his discharge; or should he die in hospital, from his estate. "Any expenses" may be taken to mean any reasonable expenses, and "maintaining" includes medical attendance, nursing, drugs, &c.,—there is no difficulty in interpreting the clause so far, nor till one comes to the word "pauper." It is only expenses incurred in maintaining a non-pauper patient that can be recovered from the patient; thus, wherever it has been sought to give effect to this clause, the question has arisen, who is and who is not a pauper? A pauper may mean simply a poor person, or it may mean a person actually in receipt of parish relief. If the former, then very few of those treated in a local authority's hospital are liable for maintenance charges; if the latter, then an overwhelming proportion are liable. It is perhaps unfortunate that the word "pauper" comes to be used, yet one can easily understand how this happened.

It was doubtless the intention of the legislature that any expenses incurred by a local authority in treating patients in hospital should be recoverable—from the patients if they could pay, if not, from the guardians of the poor. The scheme of the clause is really beautiful. Powers had been given in the previous clause to local authorities to provide accommodation and treatment for their sick inhabitants, and it was foreseen that such powers would not be largely used unless the authority could hope to be reimbursed for outlay on patients. Clause 132 then comes to the support of Clause 131, and says to local authorities, "Any expenses you incur you can recover from the patient, unless he be a pauper, and in that case of course it is

the duty of the guardians of the poor to arrange for his proper treatment, and pay all charges for the same."

No doubt this ingenious clause has had the desired effect, and many a local authority has provided a hospital under the impression that it would be a self-supporting concern, any expenses incurred being recoverable. The experience of a few years suffices to put to flight this delusion. The medical officer is asked to estimate the cost of maintenance, nursing, &c., and he finds it about 4s. per day per patient—this will be the actual expense incurred, exclusive of allowance for wear and tear, and interest on capital sunk. Possibly a start is made by attempting to recover from each patient this charge, the result being that the hospital remains nearly empty and the actual expenses of each patient *per diem* run up to double the estimate. Then wiser counsel prevails and the maintenance charge is fixed at 2s. or 1s. 6d. *per diem*. The authority submits to an annual expenditure, not merely in respect of interest on prime cost, loss by wear, &c., but also in respect of half, or more than half, of maintenance expenses incurred. Even the reduced charge cannot be met in respect of many patients, who are yet not paupers.

Let me cite a case in my own district—three persons belonging to the family of a working artisan, earning 28s. a week, were stricken with an acute infectious disease; without savings and living on his weekly earnings, it is quite obvious this man could not afford to pay 10s. 6d. per week in respect of each of the three persons it was proposed to him to remove to hospital, still he and his could scarcely be termed paupers. Or take the familiar case of a clerk living in lodgings; he may be unemployed for weeks, at all events unemployed during his illness—how is such an one to pay even a moderate maintenance charge? The truth is a large proportion of those received into local authorities' hospitals are too indigent to pay even half the cost of their maintenance, and nevertheless do not deserve the stigma of pauperism. The voluntary support given to hospitals and dispensaries throughout the country is in recognition of the fact that there is a large class who, though not paupers, are unable to pay doctors' fees or for maintenance in hospital. Why should there be this distinction between general hospitals and infectious diseases hospitals? What proportion of patients in general hospitals pay maintenance charges? A very small number. What justification is there, then, for exacting these charges from all patients in infectious diseases hospitals? Really, it would appear as if the general hospital had better warrant for the practice than the infectious diseases hospital. The former may often be short of funds and almost driven to charging its inmates

for maintenance ; the latter, on the contrary, meets any deficit by carrying over the sum required from the rates. If a charge be made, though it be but 1s. 6d. a day, it will almost necessarily have to be remitted in many cases ; and the disagreeable duty of deciding who is to pay, and who is to be let off, falls on one of the officers of the authority. This is an invidious task, and, however conscientiously undertaken, some injustice will be done —the patient skilled in the arts of the beggar, the best whiner, will escape, while it may be the most needy will borrow the money from the pawnbroker to pay.

I would remark also that the clause throws the burden of the maintenance charge on the patients only. Of course, if the patient be an infant, it falls upon his parents or guardians; but if the patient is in service it does not (as in equity it might have done) make the master liable. I have twice tried to recover from a master, and on both occasions failed. Once the master brought his domestic servant, a minor, in his trap to the hospital, and I thought I could recover from him as her guardian; on the other occasion the patient was a seaman under articles, and I thought the large shipping firm, his employers, would be liable, but they were not. Thus, in the very cases where the hospital really does a service to well-to-do people or firms, the hospital has no claim as against the people served. For surely it is the master who is the most benefited when a hospital relieves him of the danger and the burden of a domestic servant stricken with fever. Had there been no hospital ready to receive her the master would have had to pay for medical attendance and nursing for her at his house.

Then the dividing infectious patients into two classes, and making the sanitary authority responsible for one class and the poor-law authority responsible for the other, is not a wise arrangement. It may be urged that it is an arrangement which existed before the clause under review was thought of. Such a division of infectious cases, no matter how old it is, has little to commend it, and had there been no power enabling a local authority to recover costs of maintaining non-pauper patients in hospital, the questions, What is a pauper? and What class does this or that patient belong to? would never have arisen in connection with the removal and treatment of infectious cases.

Expenses incurred for a non-pauper patient only being recoverable from him, the local authority on receiving notice of an infectious case is tempted, instead of promptly removing it, to enter upon an enquiry as to the patient's social position and means. Indeed, this is just what is commonly done. A case is reported—perhaps an initial case of typhus—the patient's

parents or friends are asked, "Are you content for the youth to be removed to hospital?"

"Yes."

"Can you pay 1s. 6d. a day for his maintenance while in hospital?"

"No—he is an apprentice, earning but 6s. a week, and that will not be paid him while he is ill."

"Can you pay on his behalf?"

"We should like to, but wages are low, and we have many little ones to feed."

"Will you sign this undertaking?—*I agree to pay maintenance charges, at the rate of 1s. 6d. per day, in respect of A.— B.—, during such time as it may be necessary to retain him in the fever hospital.*"

"We are not willing to sign it."

The outcome of this conversation is that the patient's friends are referred to the relieving officer, who, in due course (that is after some hours delay), makes his enquiries.

"Where do you work?" he asks the head of the house.

"At ——'s yard."

"What are you earning?"

"24s. a week."

"And the sick lad?"

"He works at the same yard, and has been earning 6s. a week."

"How many children have you?"

"Five, and I have school fees to pay for three of them."

"You have a separate room for the sick lad, I see, and I suppose the mother can nurse him?"

"His mother will take good care of him."

"Have you a doctor?"

"The doctor from the dispensary is seeing him."

"Then I don't know what you want," says the relieving officer. "You're not a pauper. The lad's got medical attendance and nursing, you get his medicine for nothing, you've a separate room for him, and you can pay for food for him out of 24s. a week, I hope."

Accordingly the lad is *not removed*, and remains a source of infection in what may be a crowded district. Other members of the family catch the disease, neighbours catch it, and so it spreads; and ultimately the local sanitary authority and the poor-law authority are both put to a considerable expenditure in vainly endeavouring to check an epidemic that might have been stamped out at the outset for a mere bagatelle.

Or suppose that after the local authority's representative has interviewed the sick man and abandoned him, the relieving officer finds that the patient does come within the definition of

a pauper and sends the parish doctor to him, and the parish doctor has the patient removed to the fever ward at the workhouse; the removal is probably not effected till a day or more later than it might have been by the local authority, and this delay means probably increased risk to the patient, and certainly the further exposure of many to infection.

But, some one may say, the Government do not now encourage the guardians of the poor to provide hospitals for infectious cases. It is now recommended that all such hospitals should be furnished and controlled by local sanitary authorities, and that the guardians should arrange with the authorities to receive pauper cases, and pay for their maintenance out of the poor rates. In districts where this official advice has been followed, there will be but one hospital for infectious diseases, and there will be no object in discussing the status of a patient, if the destination of paupers and non-paupers is the same.

My answer is that even in these happily circumstanced districts, the same interminable debate goes on.

The rule as laid down officially is that it is the duty of the guardians to arrange for the proper treatment of every person suffering from infectious disease who is without the means of obtaining such necessaries (including medical attendance and nursing), as he may require, and only when the removal of a patient is merely necessary for the purpose of isolation, and the person is not destitute either wholly or to the extent above referred to, that it devolves upon the sanitary authority to deal with the case. The sanitary inspector calls and practically applies the rule by asking the question—Can the patient or those in charge of him pay 1s. 6d. or 2s. a-day maintenance while in hospital? If the answer is in the affirmative the patient is at once removed; if in the negative those in charge are instructed to make application to the relieving officer, as the guardians will only pay for cases sent in by their own officer. When the application to the relieving officer is successful the patient is sent to hospital, though not till some hours later than he would have been; when it is not successful (as often happens), the patient's friends come back to the sanitary inspector, and the representatives of two public authorities squabble about the patient till advice is received that he is dead —then "the last scene of all," the sanitary officer buries the hatchet while the relieving officer buries the body. Meanwhile, the disease has spread and both authorities are put to charges a hundredfold greater than the few shillings they were unwilling to risk.

Man is only too prone to fight about trifles, and sanitary and poor law authorities and their officers are no exceptions to this

rule; but this unfortunate clause in the Public Health Act (the 132nd) seems specially designed to embroil those who have to give effect to it. What shall we say of it?

> "It tutors nature: artificial strife
> Lives in these touches, livelier than life."

And how wholly unimportant is the matter in dispute. So long as initial cases of infectious disease are properly isolated, of what consequence is it who bears the cost of their maintenance for a few weeks? Whenever isolation is not practicable at home, get the patient removed as soon as reported—the safety of the community demands this. The question as to who is to pay may be discussed at leisure, i.e., never till after the removal of the patient. If the patient or his friends are willing to pay, there can be no objection to the sanitary authority receiving the money proffered; but there should be no dunning of a patient, or seeking to recover maintenance charges by any legal process. Again, if the guardians object to pay for patients who are obviously paupers, there is no occasion for the sanitary authority to grieve or wax indignant. The whole action of sanitary authorities is taken in the interest of the public health, quite as much when the authorities isolate infectious patients as when they flush sewers or remove garbage. Why should not the cost be discharged from the public rates in one case as in the other?

Truly it is a melancholy spectacle health officers have been called to witness for years past. Here is one of the most beneficent and necessary provisions for checking the spread of infection rendered almost nugatory, just because two authorities have been set by the ears and cannot agree as to which of two accounts certain small payments are to appear in. In my own town the overseers' assessment is accepted as the rateable value by those who gather the borough rates no less than by those who gather the poor rates, and though the districts covered by the two levies are not quite co-terminous, practically both rates come out of the same pockets in the same proportions. Elsewhere, I apprehend, it is not usual to have two assessments, and if it were they would not differ materially. Thus the matter in dispute is commonly a question whether the householder shall pay an $\frac{1}{8}$ of a farthing less poor rate and an $\frac{1}{8}$ of a farthing more borough rate, or *vice versâ*. Rather than this scandal shall continue, let the simple rule be adopted of having all public hospitals for infectious diseases free, as surgical and general hospitals usually are. It is doubtless for the advantage of the patient to be comfortably lodged and nursed and treated in hospital, but it is primarily in the interest of the community that the *infectious* patient is

removed to hospital. It would be really profitable to any local community to pay an infectious patient a pound a week to permit himself to be isolated in hospital; and yet when he is willing to go to hospital, and his family are willing to let him go, all sorts of obstacles are placed in his way; and the local authority, in the spirit of a petty tradesman, worries him to pay for his bottle of physic, his bread and milk, and his beef tea.

[*This discussion applies to the three preceding papers by* Drs. E. Seaton, J. F. J. Sykes, *and* F. Vacher.]

The discussion was opened by Dr. Goldie (Leeds), who held that it was frivolous to fight about the eighth of a farthing as to who should pay for removal, the Board of Guardians or the Local Authorities. He had given it as his opinion to the Local Authority that it was their duty to remove all cases of infectious disease and discuss the question of payment afterwards.

Dr. A. Hill (Birmingham) stated that in Birmingham they had a voluntary system of notification, and they were liberal enough to offer 5s. for every case that was removed to the hospital, and 2s. 6d. for every case notified to them but not removed. Still that bribe was not sufficient to induce medical men to report cases. He admitted many in the profession made sacrifices, but that was not the case all through. There were some very right-minded men in the profession, but there were some it must be acknowledged who were anything but right-minded.

Mr. H. E. Armstrong (Newcastle) argued in favour of powers being granted for compulsory isolation, and for the compulsory disinfection of houses.

Dr. Vernon (Southport) said that at the town from which he came there had been no difficulty such as that alluded to by Dr. Vacher. He was perfectly at liberty to send any patient suffering from an infectious disease to the hospital, the payment for the case being settled afterwards. Those who could pay, and would pay, were allowed to pay, and those who could not pay were paid for out of the rates. With regard to the question of compulsory notification, he might say that there had been two or three battles royal on the question, and in each case the sanitary authority had been, he was sorry to say, beaten by the medical profession.

Dr. J. W. Taylor (Scarborough) took serious objection to the medical practitioner being the one who was compelled to notify infectious

cases, and was of opinion that the householder should be compelled to notify in conjunction with the medical man. He also drew attention to the ignorance of laymen as to the nature of scarlatina, and pointed out that it was the same as scarlet fever. As to disinfection, he mentioned that in Scarborough one of the best known forms of disinfectors is used, and all infected articles are disinfected *free of cost.*

The CHAIRMAN, Prof. F. DE CHAUMONT, mentioned that with regard to the notification of disease, the practice on the Continent, especially in Holland, was to make it compulsory from both householder and medical man.

Dr. MALCOMSON (Middlesboro'-on-Tees) stated that at that town all the ratepayers and their families and servants were admitted free to the fever hospital, and that the Guardians of the poor paid 35s. per week to the Corporation for pauper patients. The fact that a person had had the Union medical man was taken as a proof that the person was a pauper, and the amount was paid cheerfully, because it was felt to be cheaper to carry this out than for the Guardians to have a hospital.

SECTION II.

ENGINEERING AND ARCHITECTURE.

ADDRESS

By Baldwin Latham,

M.Inst.C.E., F.G.S., F.S.S., F.R.Met.Soc., &c.

PRESIDENT OF THE SECTION.

In presiding over this section, which is devoted to engineering and architectural subjects, it is necessary that I should say that I have been requested to address you upon a subject which properly belongs to the Climatological Section, namely, upon the probable influence of ground water on health. This request has no doubt been made in consequence of some observations which have been made in this city by Mr. North, the Medical Officer of Health, who has traced some connection between an outbreak of typhoid fever which occurred here in 1884 and the movements of the subsoil water at that time.

Having devoted much time, during the past eleven years, specially to the study of the question of underground water, and having established and maintained a number of stations for observing the relative height of subsoil water in various parts of the country, and having also collected the past records which are available in this country and elsewhere, I am in possession of facts not easily obtainable, and am able, therefore, to draw some definite conclusions as to the probable influence of ground water upon health.

Turning to what may be called historical records, periods of great drought clearly indicate a low state of the ground water, and in ancient records there are some remarkable references to the influence of drought in producing disease.

In the Volume of Sacred Writ, Zechariah, Chap. 14, v. 17 and 18, the effect of the absence of rain in producing plague is clearly set forth, and in a passage in Revelations, Chap. 11, v. 6, men-

tion is made of the with-holding of rain and the production of plague.

Aristotle placed Zoroaster at 6,000 years before Plato, and the latter lived about 360 years before Christ. In the Avesta we have clearly laid down the fact that the absence of rain produces disease.

In these sacred writings it will be observed that the pollution of the earth, water, or air, from any cause, is looked upon as a deadly sin.

The influence of light in destroying noxious properties arising from decomposing matter is also clearly indicated, and it is pointed out that the effect of keeping back the waters of the sky and not suffering them to be poured down on the earth, would be that the noxious animals which live in the water would pollute it.

Again, it is pointed out that the star Tistrya raises the vapours out of the sea and draws the clouds forward, causing the rain to fall. This star was looked up to as the distributor of water, and it is recorded that when the star went to the sea a burning demon came out and scared Tistrya from it. Then the deity of heaven gave strength to Tistrya, and he returned to the sea, and the burning demon came out against him, but was defeated and driven away. Tistrya then raises the vapours of the sea and draws the clouds forward, causing the rain to fall, and so drives away sickness.

No inquiry into the question of the influence of climate on disease would be complete without reference to the labours of Hippocrates. It is curious to note in his works, written upwards of 2,000 years ago, that there are conditions recorded, attending healthy and unhealthy seasons, which are identical with the conditions which may be observed in this country at the present day. Hippocrates taught that all disease may be traced to natural causes, and he counted it impiety to maintain that any one more than another is an infliction of the Deity; and he pointed out to his followers that if they wished to study medicine properly, they must in the first place study the seasons of the year, and the effects which they produce. He also stated that acute diseases occur in periods of drought, and that you could tell what epidemic diseases would attack a city either in summer or winter, and what sickness each individual would be in danger of experiencing. He went much further than our knowledge at the present time enables us to go, for he stated that the changes of the seasons may be predicted from the rising and setting of the stars, so that we could know beforehand what sort of a year would ensue. Hippocrates also pointed out the conditions affecting the health of any period: with rain

in autumn, a mild winter, neither very tepid nor unseasonably cold, and rain in spring and summer, the year is likely to prove healthy; but if the winter is dry, and the spring showery, the summer will necessarily be of a febrile character. If, at the rising of the Dog-star, rains and wintry storms supervene, there is reason to hope that disease will cease, and the autumn will be healthy.

It is curious that a dry winter is often the precursor of disease, not at that time, but in the following autumn. As a rule a short supply of rain in December has a most marked influence upon the stores of underground water, and a deficiency of rain in this month has probably a greater effect in influencing the future health of any particular district than it has in any other month of the year. As a type of a healthy season the present year is an example, and fully complies with the conditions laid down by Hippocrates.

In classic times pestilence was ascribed to the anger of the Sun-God Apollo, or to his twin-sister Diana, the moon, and certainly with very good reason.

> "Along Olympus' heights he passed, his heart
> Burning with wrath ; behind his shoulders hung
> His bow and ample quiver; at his back
> Rattled the fateful arrows as he moved.
> Like the night cloud he passed ; and from afar
> He bent against the ships, and sped the bolt;
> And fierce and deadly twanged the silver bow.
> First on the mules and dogs, on man the last
> Was poured the arrowy storm ; and through the camp
> Constant and numerous blazed the funeral fires."—*Homer.*

It may be interesting to note that some years ago Dr. Laycock published an interesting account showing the incidence of disease in York, from which it appeared that this city was always susceptible to violent outbreaks of disease, traceable to local sanitary circumstances combined with peculiar climatological conditions, and that there appeared the same incidence in the prevalence of the sweating sickness of 1550–51, the plague of 1604, and the cholera of 1832, to which may be added the typhoid fever of 1884.

The results of my prolonged investigations on the subject of ground water in this country and elsewhere, clearly show that there is generally a direct parallelism between the conditions of health and the volume of ground water. The years in which there has been a large quantity of ground water present have invariably been the healthiest years, while those in which there

has been a small quantity have as invariably been the most unhealthy periods.

As a rule the lowness of the ground water indicates the future health, and not the state of health at the particular time of lowness, that is, the unhealthy period, as a rule, follows the period of low water—the degree of lowness indicating the intensity of future disease, especially fever. Sometimes an unhealthy period runs concurrently with the period of low water, but in all these cases there is clear evidence that percolation has recommenced before the unhealthy period takes place. These results are entirely confirmed by observations which were carried on in Paris between the years 1868 and 1883, and which have been collated and published by M. Durand Claye, Chief Engineer of the Municipality of Paris, with the object of putting all the facts and circumstances in connection with the outbreaks of fever in Paris at the disposal of those who might choose to investigate the subject—a course strongly contrasting with the conduct of some authorities in this country, who desire rather to hide the true facts from public view.

The observations which have been published by Professor Pettenkofer, and which were commenced in 1854, differ from the experience gained in this country, as he has shown that typhoid fever in Munich commenced with the fall of the subsoil water, and reached its greatest intensity with the greatest degree of lowness, and with the rise of the water there was a diminution of fever, a result exactly contrary to experience in this country. Professor Pettenkofer's observations, however, agree with the observations made here in the fact that the greatest intensity of typhoid fever coincides with the periods of the greatest degree of low ground water, that is those years in which the subsoil water has fallen to its lowest level are those in which there has been the most fever.

With regard also to the experience in this country as to subsoil water, it may be pointed out that there is clear evidence that the lowering of the subsoil water by artificial means will produce, and does produce, a tendency to the development and dissemination of typhoid fever. The effect of drainage works, during their construction, in lowering the subsoil water where precautions have not been taken to speedily and permanently get the water back to its proper level, has been, in many instances, to cause outbreaks of typhoid fever, which at the time have been attributed to the sewerage works and to sewer gas, even in cases where no connections had, at the time of the outbreak, been made with the sewers.

It may also be pointed out that at the time of the outbreak of cholera in East London, in 1866, as to the cause of which

there has been so much dispute, the very district which was most afflicted with cholera, had, at the time, its subsoil water unduly lowered by the construction of the main drainage works in that part of the Metropolis, but on the completion of this work, when the sewers were brought into operation, the epidemic ceased.

In regard to outbreaks of cholera in this country, I have not been able to find any record showing the actual state of the subsoil water in 1832, the time of the first outbreak of cholera; but in 1831, there was clearly a deficiency of rainfall, which points to the fact that in the following year the subsoil water would probably be low. In 1847, the year preceding the cholera outbreak of 1848–9, the subsoil water over a large area was undoubtedly low. In the cholera outbreak of 1854, we had a very low period of subsoil water over a large part of the country, and in 1865, immediately preceding the outbreak of cholera in 1866, a similar state of things occurred. With reference to cholera, it should be noted that the conditions of underground water which affect the outbreak, should be observed in those countries where the disease first makes its appearance.

It is curious that in recent times as a rule there has been, every ten years, a marked period of low water; for example, in 1834–5, 1844–5, 1854–5, 1864–5, 1874–5, 1884–5. The lowest water in this series probably occurred in 1864–5. In 1844–5 the low water was not intensely low, but it was low compared with the period. In addition to these periods, there are other times of low water, and in investigating the subject it should be studied locally and comparison made with local vital statistics, for the largely varying distribution of rain tends to equalise results when spread over large areas, as the same conditions rarely occur over extended areas at the same time.

I have carried on, as many of you know, very extensive observations at Croydon on ground water, and in consequence of the results there obtained I have extended them into various geological formations in different parts of the country. I propose now, however, to deal with some of the Croydon results, not that Croydon possesses any exceptional circumstances either with regard to health or disease, but that my intimate knowledge of the district enables me to study all the attendant conditions, and, moreover, in Croydon and its neighbourhood we possess a long record of the condition of the ground water.

The register of Croydon goes back to the year 1539, and with the exception of years in which there has been revolution, or disturbing causes of a kindred character, the record is complete. A tabulation of the whole of the burials and baptisms, extending from this early period to a date overlapping that

when registration of births and deaths commenced, clearly indicates that years of drought are, without exception, the most unhealthy periods.

We possess too, in this country, rainfall records extending back over a period of 200 years, and we have a large amount of concurrent history telling of the state of the weather from very early periods. For example, in 1539, the first year of registration at Croydon, there is a record that in this particular year the springs were remarkably low, so low that the River Lea was nearly dried up, and writers of that age remark on the great drought and heat of that period. In that year the number of burials recorded in Croydon was 50, and the number of baptisms 55, indicating a probable death-rate of 25·6 per thousand. In the following year on the rise of the water, the burials rose to 87, and the baptisms 72, indicating that the death-rate was nearly 32 per thousand. Coming to the period when we have rainfall records, the year 1741 was a very dry time, the rainfall at Lyndon for the year being 15·7 inches, and in that year the burials in Croydon were 271, and the baptisms 113, giving a probable death-rate of 63·7 per thousand, while in the two years preceding this year, the death-rate was 27·7 and 40·7 per thousand, and in the following year 24·2 per thousand. As we arrive at more recent periods when we have the certain records collected by the Registrar-General, registration having commenced in the dry year of 1837, the death-rate at Croydon was 30 in the thousand; in that year and in the following year a similar rate occurred. In the years of very low water 1854 and 1855, we had death-rates of 26·84 and 21·14 respectively, while in 1851, the death-rate was only 18·72 per thousand. In the dry periods 1864 and 1865, we had death-rates of 21·5 and 22·7 per thousand, while in 1860, a wet year and one of high springs, the death-rate was only 17·27 per thousand. The year 1871 was another dry period, but the low water at Croydon was not so intense in this year as in other years. The death-rate was not so high, viz., 18·89 per thousand, but in 1873 when the springs were very high, the death-rate fell to 16·59 per thousand. After the dry period of 1874–5, the death-rate rose again to 21·10 per thousand. From 1876 up to the beginning of 1884, there was unprecedented high water, and during the whole of this period the country generally enjoyed a high state of public health. The conditions, however, which have secured for us the estimable boon of good health, by removing the cause of much sickness, suffering, and death, have been disastrous to the agriculturist, as the large quantity of water passing into the ground has washed away the fertilising elements.

By reference to the returns of the Registrar-General, which

show the deaths in every quarter of the year, it will be seen that, with the single exception of the September quarter of 1849, the period of the cholera epidemic, the most unhealthy periods are invariably those quarters immediately following the periods of low water; as for example, the March quarters of 1838, 1845, 1847, 1853, 1855, 1864, 1865, 1866, 1875, and the increase of deaths in these quarters is so large as to clearly indicate a direct connection between the sanitary influence which the state of underground water denotes, and that of public health. With regard to deaths from fever, in recent times the years in which there has been the lowest subsoil water generally in the country are shown to be the most unhealthy, as for instance the two years 1864, 1865.

The year 1884 was an exceptional year in Croydon, and it is by means of such exceptional periods that we are able to draw some conclusions as to the probable influence of ground water upon health. It is clear to my mind, after the most careful consideration of this subject, that ground water itself has no influence, either for good or evil, upon health, but that the lowness or the highness of the water in the ground is the index of conditions which greatly influence the health of all communities. We have periods of abundance of water, and periods of low water with both healthy and unhealthy conditions. Ground water has been shown by Professor Pettenkofer to be chemically more impure in periods of high water when the conditions were favourable to health than when there is a low state of the ground water, and the conditions are unfavourable to health. The records also show that we have had periods when rain has brought malignant diseases into existence, while, on the other hand, we have similar heavy rainfalls accompanied by a high state of public health, as in the present year.

The records clearly point out that it is not one circumstance alone which produces disease, but that there are at least three factors necessary for the production and distribution of disease, especially typhoid fever, viz.:—

1. The elements which produce disease, such as a polluted state of the ground.
2. The conditions which are necessary for the development of disease, such as a period of dryness of the ground in those regions which are usually occupied by water, combined with a comparatively high degree of temperature.
3. Conditions which will lead to the spread of the disease such as the probable influence of a storm or rain in driving impurities out of the ground into our water

supplies, or through the instrumentality of ground air passing into our habitations, and its reception by a population which is in a condition to receive such germs of disease.

If any one of these conditions is absent, diseases like typhoid do not occur.

The long period of washing and purification which the ground has passed through since 1876, has generally so purified it from the producing elements of typhoid fever that, with the exception of occasional cases of impurity where the ground has become fouled from the leakage of sewage from the imperfect sewers and other direct sources of pollution, as in the case of this city, Beverley, Kidderminster, and some other places which suffered from epidemics in the low water period of 1884, the country has enjoyed comparative immunity from diseases of this class. On the other hand, if we take a period when there has been marked low water for a number of years, followed by unusually low water at particular periods, these are the times when typhoid fever is most rife, as for example between 1854 and 1865, excepting only the years 1860 and 1861, when we had a high state of ground water. The intensity of the fever rates of 1865 and 1866 point out a lesson which ought to be learnt by every sanitarian—that we must keep the ground free from impurity, if we wish to secure conditions which are essential for the promotion of health.

When we come to deal with local conditions preceding disease, we find that not only cholera and typhoid fever, as pointed out by Prof. Pettenkofer, are amenable to the conditions indicated by the highness or lowness of the ground water, but probably all other zymotic diseases, with the exception of diarrhœa, are influenced by the conditions which produce low ground water. At the Leamington Congress of this Institute in 1877, in a paper which I read on this subject, I quoted and reproduced a table from the work of Dr. Macpherson, showing that the incidence of small-pox and cholera was identical at Calcutta, and that both these diseases became virulent at the period of lowest ground water. Small-pox in this country appears to occur when the ground is drying, and is most prevalent in the years of lowest ground water. The conditions affecting measles are almost identical with those of small-pox. Scarlet fever and diphtheria follow almost on the lines of typhoid. They are the least prevalent in the years of highest ground water, and rise and fall with the increase and diminution of percolation. Whooping cough is ordinarily most prevalent at those periods of the year when the ground water is at its highest position, but is also prevalent in years of low ground water. The period of

percolation is that when most of the zymotic diseases run their usual course, that is, they commence with percolation and gradually decline as it ceases. Fifty years of percolation observations at Nash Mills carried on by Messrs. Dickenson, and more recently by Dr. John Evans, F.R.S., when put into tabular form, show percolation to be almost co-incident with zymotic diseases.

We must not, however, lose sight of other conditions which are at work, such as—

(1.) *The influence of light.* It will be observed with reference to the period of percolation that it is almost parallel with the time the sun is below the horizon. The influence of solar light is well-known in malarious countries, which may be traversed with impunity while the sun is above the horizon, but not after night-fall.

(2.) *The influence of temperature.* There is no doubt that, in winter time, many diseases are aggravated by the intensity of cold, but cold is not a general cause of disease, especially in children under five years of age. This was shown by the late Dr. Farr, and in the volume recently published by the Sanitary Institute, it is pointed out that the death-rate of children in Norway is lower than that of England, while the death-rate of children in England is lower than in Italy, indicating that at this period of existence cold is not detrimental to life. When we come to isolate the deaths in particular months, and compare them with the periods of low water, it often happens that extreme low water in winter corresponds with periods of great cold, and low water in summer also corresponds with periods of great heat. It is only at such times when we are able to discount these influences by comparing them with periods when we have a normal state of things with reference to temperature, and abnormal in regard to ground water, that the influences measured by the ground water are brought into prominent relief.

In the records which have been published by M. A. Durand-Claye, for Paris, data are supplied which give information upon a variety of conditions likely, or unlikely, to affect or influence the development of typhoid fever, such, for example, as barometric pressure, wind direction and force, temperature, rainfall, observations with the actinometer, hygrometer, evaporation, geological character of soil, physical character of soil, height of ground water, density of population, distribution of water of various kinds, distribution of baths, lavatories, wash-houses, distribution of furnished apartments, length of sewers both in district and constructed during the period of epidemic in 1882.

Prof. Pettenkofer, in his researches, has not ignored the conditions which affect epidemic disease, for example the conditions

of wealth as contrasted with poverty. He clearly shows that poverty has a marked influence in the dissemination of disease, and that epidemics fall more lightly upon the wealthy classes than upon those who are not so happily circumstanced. However, occasionally typhoid fever attacks the wealthy classes more violently than those less favourably circumstanced, as was the case in Croydon in 1875. In this instance the best districts were in the position of receiving the poison in great intensity.

The records of Paris show that typhoid fever is lowest in June and highest in December and January. The increase generally takes place in August, or the period when percolation first commences. An exactly similar state of things is shown to be the case in Croydon. When the number of deaths is small the curve is not clearly indicated, but the lowest number of deaths occurs in June and the highest in January. The following figures show the proportion in the respective months in the period of registration at Croydon from 1837 to 1886, and in Paris 1865–69 and 1872–81.

Month.	Croydon.	Paris.
January	152	1,478
February	97	1,585
March	100	1,496
April	118	1,278
May	99	1,080
June	73	933
July	87	1,200
August	89	1,904
September	106	1,884
October	116	2,014
November	130	1,975
December	110	1,641
Totals	1,277	18,468

The different length of each month must be taken into account, and in the case of Croydon, where the numbers are small, the influence of epidemic periods interferes with regular order; but when these separate interferences which tend to swell the numbers in particular months—as, for instance, in April—are studied, they become clear indices, and point more directly to the conditions attending this particular disorder.

A very marked circumstance in connection with ground water, and the period of percolation, is shown in the case of deaths of children under five years of age. While there may have been mistakes with reference to the causes from which a child dies, very little error occurs with regard to its age. I am of opinion,

that the proper way of estimating the sanitary state of any period in any district, is by taking the number of children under five years of age, and calculating the deaths by the number living at these ages. The figures show, especially after deducting the deaths from diarrhœa, which are influenced by high temperature, that there is an almost exact parallelism between the period of percolation, and that of deaths occurring at those ages, the smallest number of children dying in the month of June, and the largest number in December and January. Moreover, the death-rate from year to year, fluctuates in a very marked manner with the fluctuations of the ground water. The most healthy periods are those in which there is the most ground water, and the least healthy are those in which there is the least ground water in any year. These results corroborate the strong relation which apparently exists between the state of water in the ground and zymotic diseases. It also shows that there are influences at work, which can be measured by the quantity of water in the ground, and which are destructive to young life, but which may be guarded against, as these influences indicate themselves many months before they begin to affect the population, therefore "to be forewarned is to be forearmed."

The fluctuation of the water line therefore is an essential condition in the development of disease, especially typhoid fever and cholera. It has been pointed out by Professor Pettenkofer that in those districts in which the rivers are held up at uniform levels by weirs, the conditions are favourable to health, and in such districts cholera rarely becomes epidemic. In a great measure this is corroborated in this country by the state of health at our sea-side resorts, which being the natural outflow for ground water, and owing to the uniform height of mean tide level, are without exception placed in a condition favourable to health. We have also the record in connection with the City of York, in which it is clearly shown by Dr. Laycock, in his report on York, published in the first volume of the Health of Towns Commission, that previous to the construction of the lock at Naburn below the city, the tide used to flow up above York, and there were considerable variations in the level of the waters from time to time, but after the construction of the lock in question the health of York materially improved. The health of districts, such as the Wandle Valley, is proverbial. In the latter district there are a large number of mills in a comparatively short length holding up the water to a uniform level.

With such examples for our guidance, it is clear that sewers may be of great advantage in maintaining uniformity in the water level. On the other hand, leaky sewers are liable not only to pollute the ground, but to cause considerably greater varia-

tion in the levels of underground water than would otherwise occur in various parts of the district. Good land drainage has a tendency to produce uniformity of water level, but such uniformity should rarely be attempted to be secured through the instrumentality of sewers carrying polluted matters. The influences which are observed clearly point out how important it is to guard districts against pollution of the earth. How little regard, however, has been paid to this point, for it is only within the last ten years that the importance of making sewers as water-tight as possible has received serious consideration, and still, in many parts of the country, sewers are being constructed without any regard to water-tightness and their other influences on ground water. Moreover, a large number of burial grounds have been established, in quite recent periods, in positions with respect to underground water which must more or less exercise a baneful influence on the health of the localities in which they are situated. Cess-pools, ash-pits and middensteads are still permitted to poison the air, ground, and water. No wonder that the towns which possess the means of most readily polluting the ground have, without exception, the highest rates of mortality. There can be no compromise in sanitary matters. It should be the aim of all sanitarians to preserve the ground from all impurities, especially in districts where the soil is of a porous character, and, above all, no supplies of water for dietetic purposes should be taken from wells sunk in the immediate subsoil in populous places; and finally, to secure the full measure of health, our houses should be so constructed as to prevent the admission of ground air into them.

The President of the Congress, Sir T. Spencer Wells, Bart., said, from the way in which the address of the President of the Section had been received, it was almost unnecessary to move a vote of thanks to him, but as the address could not be debated, he would ask the Dean of York to speak.

The Dean of York, rising in obedience to the call which had been made upon him, said he really did not know how to express his sense of the vastness of the subject, nor of the marvellous care, intelligence, and perseverence with which it had been dealt with by Mr. Baldwin Latham, and he offered his own tribute of appreciation of the extraordinary labour displayed in this address. This question of water supply had been one which had received the greatest attention of all peoples from the earliest times. The speaker had referred to the writing in the Scripture of the time of Zechariah; but

the subject was one of interest to Abraham, and there were many interesting passages concerning the matter which the President of the Section had discussed in this paper. What he had heard had impressed him with a sense of responsibility in regard to doing all that was possible to keep our supplies of water pure and unpolluted, and it was to be hoped that all persons who had had facts of such importance laid before them would do all they could to strengthen the hands of all who, like the President of the Section, were endeavouring to keep pure the supplies of water.

Mr. Rogers Field (London), in seconding the vote, said that though he was aware there was some difference of opinion on some of the points raised by Mr. Latham, he coincided generally with the views expressed in the address, and more especially in what had been stated as to the lesson to be drawn by every sanitarian from the facts related, viz., that the ground must be kept clear from pollution if we wished to secure conditions essential to health. The speaker gave particulars of two cases which had come under his notice bearing upon the subjects under review, one being in connection with a large mansion in the Midlands, and the other in relation to a lunatic asylum in the West of England, in which there had been pollution of the water supplies, one from the drainage percolating into the wells, and the other by the drainage from a graveyard.

On "River Pollution," by Professor Henry Robinson, M.Inst.C.E., F.G.S.

In view of the near approach of legislation on local government, there is every prospect that the long delayed subject of the prevention of the pollution of the rivers of this country will receive the attention which it deserves. In an address on "River Pollution," which was delivered at the "Parkes Museum of Hygiene" in 1885, I called attention to the various Bills which had been brought before Parliament for the purpose of effecting some improvement on the existing unsatisfactory state of affairs. I referred to the Standards of purity which were proposed to be adopted, and which have been the cause of much difference of opinion even amongst those who are striving to accomplish some reform. As this address elicited an expression of opinion from many well known authorities who took part in the discussion upon the occasion,

and as the various Bills were specified, and the Standards given, I have placed on the table a few printed copies of these proceedings for the use of those who may wish to refer to them. Since the date of that address a further Bill for the Purification of Rivers was prepared and brought into the House of Commons by Mr. Hastings, Earl Percy, and Colonel Walrond, acting in conjunction with Mr. Willis-Bund and Mr. Burchell, who have worked arduously and earnestly in the cause. This Bill, besides conferring on the sanitary authorities mandatory powers instead of permissive (as in the case of the Rivers Pollution Prevention Act, 1876), contained also a Schedule of Standards for liquids that may be discharged into streams. It also contained a clause for the removal of complaints from the County Courts to the High Court of Justice. This Bill was, however, withdrawn, the vexed question of the Standards causing, I think, the loss of support from some quarters.

In 1886 a short Bill was brought into the House of Lords by Lord Balfour, to amend the Pollution Prevention Act, 1876. No Schedule of Standards was annexed to this Bill, and this I consider was a very wise departure from some of the previous Bills. This, however, was not proceeded with, owing, I believe, to the disturbed state of business in the last session of Parliament. The simple provisions of this Bill appear to me to remove the grounds of opposition which applied to that of 1885, and it is to be hoped that the promoters of it may have their hands strengthened by the support of this Congress in their efforts to obtain a much needed reform.

The Rivers Pollution Prevention Act of 1876 was "An Act to make *further provision*" for the prevention of the pollution of rivers. The "provision" referred to as then in existence prior to that Act had obviously been wholly inoperative, as the House of Lords in 1876 recorded, in the preamble of a Bill, the fact "*that the pollution of rivers had lately so increased as to become a* NATIONAL EVIL," and it is notorious that the rivers in 1876 were far fouler than they were in 1873. The "*further provision*" has proved equally inefficient. During the 10 years of its existence the pollution of rivers has continued unchecked, and their condition now is much worse than it was in 1876. The main object of further legislation should be to render that "*further provision*" effective, so that the Act of 1876 may be enforced with certainty, and with the least possible friction, real or imaginary, as regards all existing interests. No alteration should be made either in its peremptory prohibitions against the offence, or in the exemptions therefrom embodied in Sections 3, 4, and 5, for the protection of Sewer Authorities, Manufacturers, and Miners using proper means for preventing

river pollution. The restrictive enactments introduced in its 6th Section should be revoked as they have paralyzed the action of the Statute and rendered practically worthless its prohibitions. The removal alone of those restrictions would give vigour to the Act and efficacy to its prohibitions, and by converting the permissive powers into mandatory requirement, the effective operation of the law would be secured. The utmost protection should be afforded to the sewer authority, as well as to the manufacturer and the miner who is doing (as he surely ought to be compelled to do) all that reasonably can be done to prevent or lessen such a fearful public nuisance.

There is no longer any excuse for discharging sewage in an unpurified state, as the conditions which have to be observed in the purification of sewage matter are now well known, and are capable of being easily complied with. The field of conflict which a sanitary authority has now to enter upon in carrying out a scheme of sewage disposal has been so much narrowed by the experience of recent years, that no difficulty has to be encountered which should deter an authority from taking steps to cease to offend in this respect. My experience leads me to think that in sewering large districts it is often undesirable to concentrate the sewage at one point. Very costly works can in many cases be avoided by sub-dividing an extensive area into a few groups for sewerage purposes, according to the physical conditions which exist.

The data and opinions that are given in my book on "Sewage Disposal,"* apply as truly now as they did when it was written.

The chemical treatment of sewage by simple and well known means, enables a fair standard of purification to be attained. Where the highest standard is necessary, it can be effected by the subsequent filtration of the effluent water through a small area of land or through an artificially prepared filtration bed.

The sludge from chemical treatment no longer presents the difficulty which was originally experienced. The mechanical reduction of the sludge from a liquid to a semi-solid condition is now easily carried out in presses. The successful pressing of sewage matter into a form which enables it to be economically removed from the place of production, disposes of one of the difficulties which has to be met in dealing with sewage upon land. The abstraction of the larger and more clogging matters from sewage, by means of screening tanks, before the sewage is passed through land, is

* Robinson, "Sewage Disposal." Spon, London.

now recognized as greatly aiding the soil in its purifying action, and as simplifying the work of irrigation by rendering the dissolved fertilizing ingredients in sewage more capable of being assimilated and utilized. In my own practice, I employ upward screening tanks to retain the larger suspended matters underneath the screening material, by which the matter thus retained is not exposed to the air until its removal either to be pressed or to be otherwise dealt with. The cakes can now be made as thick as two inches, this being now done by Mr. Crimp at the Wimbledon Sewage Works. By mixing about 5 per cent. of fresh ground lime before pressing, cakes of this thickness of two inches are obtained for about 2s. 9d. a ton containing about 50 per cent. of water. The experiments that have recently been made by Dr. Munro, of Downton College, Salisbury, indicate that sewage sludge will find an agricultural use of importance when the system of precipitation is properly conducted. A valuable communication on this subject has been made by him to the Society of Chemical Industry, and further practical researches in the same direction are now being prosecuted, the results of which are awaited with interest. His experiments show that the pressed sludges from either straining tanks, or from the better systems of chemical precipitation, require to be reduced to a finer state of subdivision than is usual (except with the "Native Guano"), to enable the nitrgoen and phosphoric acid in them to be presented to the soil in a form which admits of these valuable ingredients being assimilated and not wasted. These experiments point to sewage sludge, when properly manipulated as indicated, being a useful manure for farmers (as chemical analyses have always suggested), and offering some pecuniary return to the places producing it.

With reference to the purification of sewage upon land the experience that has now been gained prevents those mistakes being made which were fallen into in cases where irrigation was adopted under unsuitable conditions. The important researches of Mr. Warington, at Rothamstead, upon "nitrification," have thrown a flood of light upon the changes which take place when sewage matter is passed through the soil. He has established the fact that the purifying action, which was previously termed oxidisation, is due to the action of minute organisms of the bacteria family. His experiments appear to show that the organisms are generally present down to two feet from the surface, but that below this level their presence is less certain and the nitrifying powers cease, or, at all events, are exerted to a very feeble extent. The important bearing that these investigations have upon the purification of sewage

on land is that they indicate that a much less depth of soil is efficacious than was originally thought to be the case. Consequently the heavy cost of deep draining is unnecessary, and the expense involved in laying out land for sewage disposal purposes is greatly reduced.

As regards the pollution from solid and manufacturing refuse it was proved by the evidence, which was given before a Committee of the House of Lords, that no insuperable difficulty existed in the way of preventing river pollution from this cause. Sir Lyon Playfair stated in evidence before this Committee, as follows:—"If you force us to purify the water which we discharge fouled in this way, before long we shall find efficient modes of doing it. At the present moment we have not efficient modes of doing it, and yet, as one of the largest polluters of waters in the kingdom, from this very thing I advocate that you should make me purify the water before I discharge it."

The removal of the solid matter from manufacturing refuse before discharging it into rivers can be effected by mechanical means in a vast number of cases, where no attempt is now made to do so. The enforcement of such remedial measures need not interfere unfairly with trading interests if the standard of purity which is required is not unreasonable, and is not arbitrarily fixed without regard to the circumstances both of the river to be protected, and of the trader to be dealt with.

I assert with confidence that there is no justification whatever for continuing the employment of our rivers as carriers of the fluid refuse of the community. London, Glasgow, and many other large towns may be cited as abusing their rivers, and are not (as they should be) taking the lead in promptly discontinuing this pollution.

Mr. Blyth gave his experiences of tests he had made of the Thames water taken at Charing Cross, and said he found it perfectly pure, after it had settled. It was only the abuse of the river that prevented it from being used for domestic and other purposes. The water he had tested never was salt. He should have thought the tide coming up would have brought salt water with it.

Professor Hope (York) spoke on the subject as an analyst, and one who had spent much time in the study of agriculture, both practical

and scientific. He expressed his disagreement with one or two minor points, and then went on to deal with the question of the utilisation of sewage. He feared the value of the sludge as manure would not be as great as could be wished, either by the town on one hand or the farmer on the other, who would be glad to have another good manure at market value, and the town glad of an outlet for their refuse. Lime appeared to be the least desirable item to mix with organic matter intended for manure; any ammonia would be lost, which is the most valuable part, and it would further tend to cause other forms of combined nitrogen to decompose and form ammonia. He suggested that sulphate of lime in the form of gypsum, or of plaster of Paris would probably give an equal result, as far as the mechanical operation of pressing a sludge cake was concerned, and would certainly give better results as a manure. Lime would tend to increase any smell in the process of manufacture, the sulphate would tend to decrease any nuisance that might arise. Sewage systems seemed to resolve themselves into two great divisions: the sewage is taken to the land or the land is taken to the sewage. Lime and clay, the principal precipitants used, were only particular kinds of earth. In the latter case the earth, plus a small quantity of sewage, was taken back to the land as manure; the double carriage was obvious. The former system of sewage farming was the only one which had been worked to a profit. He put aside the precipitating processes as being only worthy of serious consideration when they were the only alternative, that is, in the absence of sufficient land of suitable quality for sewage farming. A sufficient quantity of suitable quality was the great difficulty, and might entail the expense of carrying the sewage some distance from the town before such land could be met with. The question asked by the town was: Upon how little land can we dispose of our sewage? The proper question to put seemed to be: How much land will our sewage fertilise? The quality is equally important with the quantity, and should be of an open sandy character, which naturally drains itself, and in such a locality that there would be no fear of damaging the water supply by percolation into the sub-soil. Such land was generally on a high level, whereas the town seeks to avoid pumping by carrying the sewage to low-lying land often of a clay character and unable to drain itself of its own rainfall, and so low that there is no outfall for artificial drainage. It seems to be thought—if actions speak louder than words—that a dry land plant can become aquatic at a moment's notice provided plenty of food be supplied. This is not only untrue but is the reverse of the truth. To get over the difficulty of draining the farm pumping is resorted to, which means pumping the rainfall of the farm in addition to the rainfall of the town, plus its sewage. How much more convenient to pump the latter to a sufficient elevation, so that it can be taken to and distributed upon land which will drain itself, and which, if farmed by a competent man and not by the town council, who cannot be expected to be versed in farming matters, there would, in times of general agricultural prosperity, be a handsome profit to the credit of the ratepayers; and in times so

adverse as the present they might reasonably expect to escape without loss, provided that the farm was not saddled with the cost of legal expenses in gaining compulsory possession of land, &c. It would be foolish to expect any scheme to pay interest on so much sunk capital as many farms are debited with. Precipitation processes had hitherto been a serious expense to the communities adopting them. They had never paid their own way; and until they were able to save the soluble nitrogen in the urine—the most valuable part—they could never hope to do so. Farmers required value for their money, and an increasing number yearly saw that they got it. The only known method of saving the soluble compounds of urine was by the living roots of plants. He had visited many sewage farms, and had made very careful enquiries as to the health of the labourers and their families living upon or adjacent to the farm, and was glad to find good health—improved health—and no trace of zymotic disease. The statement that fresh sewage was harmless appeared to be proven.

The CHAIRMAN asked Professor Hope if he could say what was the agricultural value of the sewage sludge; was it worth the 2s. 9d. a ton it cost to press?

Professor HOPE (York) replied that the value depended entirely upon the constituent part of the sludge, and he could not say unless he analysed it. To buy this material for the land without analysing it was like buying a "pig in a poke."

Mr. ROGERS FIELD, M.Inst.C.E. (London), could not agree with the suggestion in the paper that deep drainage was not necessary, because it had been shown by Mr. Warington's researches upon nitrification that the lower you go down in the soil the less are the powers of minute life to effect nitrification; and he contended that the employment of shallow drains would in many cases lead to trouble. The great objection to shallow drains was that there was a danger of the sewage passing directly to the drains instead of filtering through the soil, and this was especially the case where the soil was of such a nature that it would be liable to crack. He said, therefore, that even if it were proved beyond doubt, which he believed it had not yet been, that nitrification took place altogether on the surface, it would be advisable to drain the land some five or six feet deep, so as to avoid the danger of the sewage passing directly into the drains and being thus carried into the water-courses.

Mr. HENRY LAW, M.Inst.C.E. (London), held that there could be no doubt of the importance of putting drains at the depth of five or six feet. In regard to the so-called investigations of Mr. Blyth into the character of Thames water taken at Charing Cross, these investigations ap-

peared to be of a very primitive character, and that gentleman would find valuable information, more valuable than his own experiments, by consulting the report of the Royal Commission on the discharge of sewage into the Thames. Mr. Blyth would find from this report and the investigations of the Royal Commission, that sea water found its way up the Thames, as was clearly proved by samples of water taken opposite St. Paul's at spring tides. He could also refer to the interesting experiments made at the instance of the Corporation of London and of the Metropolitan Board of Works with floats, showing the manner in which the waters flowed and ebbed within certain limits, and Mr. Blyth would acquire much information from a study of the diagrams which had been deposited at the office of the Local Government Board. As to the use of lime in the process of solidifying sewage, a certain amount of this material was necessary in the pressing. With regard to the view of Professor Hope, that the best treatment of sewage was to take it to the land, with that the speaker agreed; but he thought that in a sanitary point of view it would not be wise to put crude sewage upon the land, inasmuch as the solid matters remained upon the surface long enough to create evils injurious to health.

Colonel Jones (Wrexham) called attention to the differences between *clarification* and *purification* of the effluent from sewage, and maintained that purification could only be obtained by means of land and plant life. Mr. Blyth would find by reference to the report of the Royal Commission, that, so far from considering that the Thames was none the worse from the pouring of sewage into it, it was held that there should not be any solid matter put into the Thames from the Nore upwards, and this was a matter of first importance. As to the scheme of the Metropolitan Board of Works, to clarify the water at Barking and Crossness outfalls by chemical treatment, he held it would be far better to adopt plans to carry the sewage lower down the river, where the solid matter could be deposited on the low-lying land, and the clarified effluent discharged into Sea Reach, "below Hole Haven," as recommended by the Royal Commission.

Major Flower (of the Lee Conservancy, London) held that much difficulty had been caused in river purification by the lawyers insisting upon standard of purity clauses in Acts of Parliament, and he regretted that Mr. Michael had retired from the council of the "National Society to secure effective Legislation against River Pollution" on some such question, which lawyers insisted was necessary. There was, in the question of the purification of rivers, not only pollution by sewage to be considered, but there was the question of manufacturing refuse, which found its way into the sewers. Now if the manufacturers could be made to see that it would be an economical benefit to themselves to utilize their wastes, there would not be the present amount of river pollution; for indeed

it was the manufacturing refuse cast into the river which caused the largest amount of the abominable condition of things. As to the disposal of sewage, he thought it must be treated first chemically, and then passed upon the land; that was to say, it could not be sent directly upon the land in all cases, and he regarded the pressing of the sludge as a capital way of treating it, and as a great advance on former methods. At Leyton, Essex, where the sludge was treated in this way, and the effluent run into the Lee, it was intended, he believed, to incinerate the cakes of sludge and reduce them to powder, and then the sewage matter to be pressed would not require lime, the powder being used instead, so the bulk of the deposit would not be increased.

Mr. M. Ogle Tarbotton (Nottingham) pointed out that the circumstances of different towns varied so greatly that it was impossible to lay down what should be one uniform system of treatment. The sewage in some places was sewage proper and nothing more; but in other places the sewage matter consisted largely of manufacturing refuse, and the sewage was, owing to fluctuating rainfalls in different localities, correspondingly diluted. From the amount of chemicals used in bleaching and dyeing, it could be readily understood that where that process was carried on the cost of purifying the sewage was greater than in other places, and hence the population generally paid for the cost of carrying away the refuse of the manufacturers.

Mr. G. Dodds (Leeds) stated that he had been informed by a manufacturer, in regard to the River Purification proposals, that if he had to give up running his refuse into the river Aire he should have to give up his business. The speaker proceeded to speak of the high estimates which were at first made of the value of deodorised sewage as manure—as much as £6 per ton, and then dealt with the terrible pollutions of the rivers near manufacturing towns. He said that he had spent some time in taking specimens of the polluted condition of the Aire, and if the Royal Commission had seen these specimens, no more evidence would have been required as to the evils wrought by manufacturing pollution.

The Chairman, Mr. Baldwin Latham, in closing the discussion, said that Professor Robinson, if he had been present, would have been quite equal to the task of dealing with the views of those who had discussed his paper. In Professor Robinson's absence he would take upon himself to point out the difference between the question of the utilisation of sewage on land, and that of the pollution of the land. In his own address he laid down three essential conditions as necessary to produce disease, and had declared that in the absence of one condition, disease was not produced. They had the experience that in the years when the ground was saturated with water the period was a healthy one, and he was not going to say that sewage farms

should be established where there was the slightest chance of contaminating underground water supplies. He could not help referring to the fact that in 1875 there was a violent epidemic of typhoid fever at Croydon, and that the sewage of this place was applied directly to land without defecation, and at that time the inhabitants surrounding the sewage farm procured their water supply from local wells, the water in which fluctuated with the proximity of the irrigation works to them; yet in this year there was not a single case of typhoid fever in that neighbourhood. He acknowledged that in some cases, where the three essential conditions for producing disease were present, there disease would come; but what he wished to impress upon the minds of his hearers was, that the placing of sewage direct upon land did not necessarily produce disease, as some seemed to think. With regard to the Bill for the Purification of Rivers, it had been stated by Major Flower that Mr. Michael had withdrawn because a standard of purity was objected to. The fact was, however, that Mr. Michael's withdrawal was due to the Bill being badly drawn. On the point of the manufacturers' pollution of the rivers, there was no desire on the part of anyone to injuriously affect manufacturers; but it would be well for manufacturers to take note of the fact that water was likely to be increasingly dear, and the more it was polluted the dearer it would become. They could not, by reason of their pollutions, use the water which flowed by their premises, and they had to buy water which was brought from a distance. Now it was for them to take into consideration whether it would not ultimately be cheaper for them to purify the water they used than to buy water. He proposed a vote of thanks to Professor Robinson for his paper. This was carried unanimously.

On "The Sheffield Corporation Sewage Works," by JOHN MERRILL, Chairman of the Sewerage and Rivers Committee, Sheffield Town Council.

THE population of Sheffield is a little over 300,000. There are about 19,000 acres within the borough, 5000 of which are sewered and drained. There is no separation of surface from house drainage, and the daily dry-weather flow is ten million gallons.

The disposal of the sewage of the borough had occupied the attention of the Council pretty continuously during the past twenty years, and although several engineers of eminence had

been consulted, no action had been taken, when about four years ago the pressure of an application to the Court of Chancery forced upon the Council a necessity for immediate action.

A Committee was at once appointed with instructions to advise the Council as to a suitable scheme, with a view to its speedy adoption. As the result of an exhaustive consideration of the subject, the Committee laid down a series of conditions which they considered indispensable in a perfect scheme, though not with the expectation of finding any one which complied with the whole of the conditions.

The conditions were :—

1. The process must not only cause no nuisance, but there must be no appreciably disagreeable smell, because in the case of sewage operations it is found that a very little smell soon gets magnified into a very great nuisance.
2. The process must be one that can be carried on at all times and in all seasons.
3. The system must be one which will lend itself to an indefinite future extension.
4. The process must completely separate the solids from the liquid, producing an effluent sufficiently pure to run into a river with a fairly rapid current.
5. The system must be one in which advantage can be taken of any new discovery or invention.
6. The quantity of land required must be small, and the process must be one that can be carried on on the confines of the borough, or within a very short distance.
7. The process must be one into which the commercial element enters as little as possible.
8. There must be no possibility of percolation into wells or springs.

A thorough examination was then made of every known process. Visits, in some cases again and again renewed, were made to what were considered the best and most representative examples of every system.

One of the first results of the Committee's enquiries was the rejection of everything in the shape of land filtration or sewage farming.

These were found to comply with scarcely any of the conditions laid down.

It was found that there was considerable nuisance attached to the process.

That it could not be carried on at all times and seasons; little or no purification taking place in the autumn and winter.

That no advantage could be taken of any new invention or discovery.

That the quantity of land required would be very large.

That the process could not be carried on near the town, there being no sufficient quantity of land for many miles, consequently the sewage would have had to be conveyed a long distance at great cost.

That the commercial element entered into the process to a considerable extent.

And that there was considerable danger of percolation into wells and springs.

The conditions complied with were :—That the system lent itself to indefinite future extension, always supposing there was sufficient land in the neighbourhood of an already established farm.

And that the effluent produced, was sufficiently good to send into a river with a fairly rapid current.

The committee were thus compelled to turn their attention to chemical treatment. Whilst several materials are used, there are, broadly speaking, only two systems of precipitation, the continuous and the intermittent.

The continuous was found to be in operation at a great number of places ; the intermittent at only one, namely, Bradford. A careful comparison of the two, showed that the continuous fulfilled a considerable number of the conditions laid down, but that it failed in several which the committee considered vital, whilst the intermittent seemed fairly to comply with all.

Both complied with the first and second conditions, namely, that the process should be carried on without nuisance, and at all times and seasons, but the continuous broke down at the third, not lending itself to indefinite future extension, it being found that if there was an increase in the quantity of sewage one of three things must happen, either that increase must be permitted to run away untreated, or the flow of the sewage through the works must be increased, thus decreasing their efficiency ; or there must be a re-construction of the works on a larger scale.

The continuous broke down also at the fourth condition, it being found in every case that there was a considerable quantity of solid matter in the effluent, such being the lightest and very foulest fœcal matter, and resulting from the constant flow being maintained.

The intermittent complied with both these conditions, being capable of any future extension, and in consequence of the sewage having a period of complete rest, entirely separating the solid matter.

Both systems seemed to comply very fairly with the other conditions.

The committee accordingly recommended the Council to adopt the intermittent system of precipitation, as in operation at Bradford, and the engineer to those works, Mr. G. Alsing, was instructed to make the necessary plans, an admirable site of about 23 acres having been secured.

The works have been completed and in operation for about four months. They cover about 7½ acres, and consist of a main building and 30 tanks, each having a capacity of 50,000 gallons, together with an oxidising weir and two filters to each tank.

The process may be said to consist of four parts or sub-processes : subsidence, precipitation, oxidation, and filtration.

The sewage enters the works and flows through four deep subsiding tanks. These act also as catch-pits, and are for the purpose of arresting any floating solids, as well as separating the heavier solids contained in the sewage. The reasons for this separation of the heavier solids are threefold : firstly, the heavier solids form a compost which can be readily and easily got rid of ; secondly, the quantity of sludge from the precipitating tanks is thereby reduced ; and thirdly, the separation of the heavier from the lighter solids abolishes all nuisance in the drying.

From the subsiding tanks, the sewage flows forward under the floor of the main building, and receives the milk of lime. It then flows through a conveying channel, which serves also as a mixing chamber, where, by a beautifully simple and ingenious arrangement, the lime is most thoroughly mixed with the sewage without the use of any machinery whatever. So intimate is this admixture, that the quantity of lime has been reduced from one ton per million gallons to fourteen cwts., a saving of about one-third. The sewage is then admitted into the precipitating tanks, which are the most important feature of this process (first introduced by Mr. Alsing, at Bradford), and from which it takes its name of intermittent precipitation.

As soon as a tank is full, the flow is shut off, and the sewage allowed to remain completely at rest. The advantages of this method of treatment are very great. By it we are able to get rid of every trace of solid matter, which cannot be done where a constant flow is maintained. The writer has examined large numbers of samples of effluent from works on the continuous principle, and never yet found one which did not contain solid matter. This consists of the lightest and foulest of the fœcal matter, and it is this which decomposes and sets up that secon-

dary fermentation which has been so much complained of in connection with precipitation works.

In the Sheffield works, twenty-five minutes after a tank is filled, complete precipitation has taken place, and the clarified sewage is as clear, bright, and colourless as spring water, and contains not so much as a trace of solid matter.

The importance of the complete removal of the solid matter cannot be over stated, because it permits the subsequent filtration of the effluent by artificial filters to any degree of purity. If the effluent from the tank contains solid matter, as with the continuous system it does, such solid matter gets into the pores of the filter, where it rapidly decomposes, rendering the filters foul and unfit for use. Another great advantage is the removal of the sludge from the tanks every time the effluent is run off, thus preventing decomposition. With the continuous system, the sludge, accumulating sometimes for weeks, decomposes and gives off gases which are taken up by the partially purified sewage flowing over it, rendering the effluent in some cases little better than raw sewage.

The next feature of the works is one entirely novel, namely, the oxidation of the effluent. Oxygen is the great purifier, and to quote the Glasgow report, "if an effluent is brought into contact with oxygen, either by churning it up with air, or passing it over numerous falls, or exposing it in a thin stratum to the air, it speedily becomes inodorous and no longer putrescible." Several methods have been proposed to effect this, one being the pumping up of the effluent and letting it fall in a broad thin stream; another, the blowing of air into it, but all these methods would be costly in practice. The problem has, however, been solved in the Sheffield works, in a very simple manner (the only cost being a slight addition in the construction), by the establishment of weirs, one to each tank. The clarified sewage runs from the tanks in a very thin stream over a weir, with a slight fall, exposing a very large surface to the air. This simple arrangement will play a very important part in the future of sewage purification.

From the weirs the sewage runs through two filters, downward and upward.

The use of filters is a very important matter for local authorities, giving them power to meet any legislative change which in the future may be made.

Supposing a standard of purity to be established by Parliament, and to be higher than is recognised at present, all that is required is to alter the filtering material, to produce any quality of effluent that may be desired, of course somewhat increasing the cost of working.

The filters are so constructed that after a tank is run off the filter used can be completely emptied of liquid and allowed a period of rest, so that the filtering material becomes re-charged with oxygen, thus increasing the efficiency of the filter and prolonging its life.

The sludge runs by gravity from the tanks into a collector, from whence it is pumped into open air drying ponds. These ponds are placed at a higher level than the tanks, consequently the supernatant liquid can be run back into the tanks and treated over again. It is found that by thus raising the drying ponds the water is more effectually run off and the sludge got into an easily portable condition.

In the neighbourhood of Sheffield there are large tracts of sandy land which at present will grow scarcely anything. Copious dressings of sewage sludge would be of great benefit to this land, and no doubt is entertained that considerable quantities, if not all of the sludge produced, will be disposed of for this purpose.

The advantages of the intermittent system are:

Simplicity.

Great efficiency.

Small tank area required in comparison with the continuous system, which may be seen from the following table:—

Daily Flow.	Tank Area.	Tank Area, calculated on basis of uniform daily flow of 10 million galls.
Continuous.		
Leeds, 10 million galls.	72,000 sq. feet	72,000 square feet
Coventry 3 „ „	33,600 „ „	112,000 „ „
Burnley 1½ „ „	18,275 „ „	122,000 „ „
Salford 5 „ „	140,000 „ „	280,000 „ „
Intermittent.		
Sheffield 10 „ „	55,000 „ „	55,000 „ „

Economy both of construction and in working.

Perhaps the most remarkable feature of the Sheffield Works is their cost, which has been £32,000.

The working expenses will not be more than £5,000 a-year.

On "Municipal Government in its Relation to the Public Health," by ALD. J. S. ROWNTREE.

NO proverbs are more venerable—not to say trite—than those which enforce the uncertain duration of human health and life. The spread of civilization and the growth of knowledge have not materially modified the force of those precepts which counsel men not to "boast of the morrow"—not to say they will do this and that a week or a year hence, forgetful that life and health may not then be theirs. But whilst this uncertainty exists in scarcely diminished force as respects the individual, the growth of historical and statistical science has demonstrated that the probable average health and duration of life, in communities of men, can be presaged with approximate accuracy. On the apparent paradox, that the duration of life and health, whilst absolutely uncertain to the individual, is comparatively certain to the community, has been erected the whole system of life and health insurance.

It has also been established with continually increasing clearness, that the vital and sanitary well-being of a community are capable of being largely influenced, for good or evil, by the action of social, economic, and political forces. In his famous chapter, on the state of the English people in 1685, Lord Macaulay has shown how much the term of human life in this country has been extended since that date, with a corresponding diminution of disease. He mentions that in 1685 one Londoner died in every twenty-three [43½ per thousand], as compared with one in forty [25 per thousand], when the eloquent historian wrote.* In his recently published essay on the progress of the working classes in the last half-century, Mr. R. Giffen has skilfully marshalled a multitude of facts in support of his argument, and amongst these, points to an average extension of life in this country, in recent years, amounting to not less than two years in males, and nearly three-and-a-half in females. †

Writers like those just quoted are chiefly dealing with the vital statistics of the people in their relation to questions of national policy. In the present paper I propose to discuss the humbler theme, of the connexion of local or municipal government with the public health, although it is hardly possible entirely to separate the action of the local from that of the

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* History of England, Vol. I., 424.
† Essays in Finance, R. Giffen, Second Series, 386–7.

central government. The local authority is often the handmaid of the central government—the executive hands carrying out the behests of the directing brain. It will not, however, be difficult to establish how influential is the action of municipal government in its relation to public health. I cannot hope to bring forward new facts, or even invest old ones with a charm of novelty for the members of the Congress, familiar as they are with sanitary science. But as one of the objects of this Congress is to increase public interest, and to enlist public opinion on the side of sanitary measures, it may be useful to repeat for a partially popular audience, facts which have become the common-places of experts. This is all I aim at in the present paper. Repeat, repeat, was the dictum of the greatest of orators. Line upon line, precept upon precept, was the motto of prophetic teaching.

In meeting at York, the Sanitary Congress has the advantage of mingling with a population living on a site that has probably been uninterruptedly inhabited for as long a time as any in great Britain. The long history of the City furnishes many illustrations of the progress of sanitary knowledge, and its present condition in the matter of health is a testimony to the value of the science which this Institute labours to advance. I propose in the first place to draw your attention to some of these illustrations drawn from the local history of York, then to glance at the sanitary achievements of some larger municipalities, and in conclusion to indicate some of the paths in which municipal governments may hope yet further to advance the health of their localities.

We know too little of Roman York—Eboracum—to induce us to speculate on its sanitary condition. Here, as in other cities of the Empire, the Romans observed some of the laws of health, which subsequent generations neglected. They interred the dead outside their walls. They sought personal cleanliness through the use of the bath. It may reasonably be assumed that here, as in Rome itself, and as was commonly the case in its provincial cities, laws were in force to secure the cleansing and repairing of drains and sewers, under the supervision of officers closely answering to the public health officers created in this country by recent legislation.

As a great military and ecclesiastical centre, York repeatedly suffered during the middle ages from the ravages of war and pestilence. Its population was subject to the diseases of those times, some of which are now unknown. In the stir of the Crusades, leprosy, which had long existed in Western Europe, appears to have become more frequent, and at a period when the population of this City was only one-fourth or one-sixth as

large as it now is, there were at least five Leper Hospitals located here. They all stood without the City walls.* Leper windows in one or two of the village churches of the neighbourhood, are another indication of the prevalence of this dreadful disease, now happily banished from this country.

Visitors to the City, as they leave the Railway Station, see before them a small cemetery, in which are interred the remains of a number of persons who died from the cholera in 1832. It has been well pointed out by the late Dr. Laycock, that the cholera mortality of 1832, though it excited intense apprehension at the time, was relatively small compared with that of previous pestilences. The deaths were 185. They would have been 9,000 had the epidemic been as fatal as the plague of 1604.† In the report of the Royal Commission on the health of towns, 1844, special attention is drawn to the essay of Dr. Laycock on the health of York. His investigations, say the commissioners, have traced back for upwards of two centuries, the operation of like physical causes, producing different forms of epidemic disease, prevalent under similar conditions, always in the greatest intensity in the same quarters of the City.

The more carefully the plagues of the middle ages have been investigated, the more impressive becomes the evidence of their frequency and malignity. It is impossible to say how often the population of York has been decimated by pestilence. But it must have occurred very many times. With the help of Dr. Laycock's papers, and other materials, I have prepared a chronological table showing the dates of the best known visitations.

York Sanitary Chronology.

1349.—The Black Death. In York 17 parish priests died out of 21. In the East Riding 59 out of 105. In the Archdeaconry of the West Riding 119 out of 200. (Seebohm in Fortnightly Review, vol. 2, p. 158.)

1363-68.—Unusual mortality. (Laycock, 250.)

1379.—Great mortality in North of England. (Gent.)

1390.—Pestilence. Sweating Sickness. Gent says 11,000 persons were buried in York this year. (An incredible statement.)

1391.—Pestilence.

1485.—Sweating Sickness appears to have been rife in York before battle of Bosworth, whence it is commonly said to have been spread through the country.

1493.—Sweating Sickness prevailing in York.

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* One at Dringhouses, one St. Katherine's Spittal on the west side of the Mount road, one St. Loy's in Monkgate, one St. Helen's in Fishergate, and one St. Nicholas on the Hull road.

† History of England, Vol. I., 424.

1500.—Archbishop Rotherham died of the plague at Cawood, "caught probably at York." (Laycock, 252.)
1550-51.—A Contagious Disease, a "playg of pestilens," exceedingly destructive of human life in York.
1550 & 52.—Corpus Christi pageant suspended on account of the plague. (Davies' York Records, 262.)
1564-5-6.—Observance of pageant again suspended in consequence of "war and sickness."
1604.—"The Great Plague in York." Mortality 3,512 in a population of about 11,000. The Lady Mayoress, Mrs. Thomas Herbert, was amongst those who died.
1631-2.—Outbreak of Plague in York. Wentworth Lord President of the North.
1682.—Water distributed in York through wooden pipes.
1715-35.—Dr. Clifton Wintringham gives the mortality in York as about 1 in 22 of population [45½ per thousand]. 1715.—Small-pox confluent. 1719.—"Putrid Fever," Typhus. 1720.—Influenza and Cholera epidemic. 1721.—Measles epidemic. 1723.—Small-pox confluent. 1725.—Measles epidemic. 1726.—Small-pox. 1728.—"Putrid Fever." 1731-34.—Small-pox.
1757.—Construction of Naburn Locks.
1777.—Dr. White estimated population of York, 12,798, mortality 1 in 28·22 [35½ per thousand].
1832.—Asiatic Cholera, 430 cases, mortality 185.
1844.—Commission on state of large towns. Dr. Laycock's report on York.
1849.—Asiatic Cholera, a slight outbreak.
1850.—Water-works removed to present locality.
1853.—York Sanitary Improvement Act passed.
1872.—Medical Officer of Health appointed.
1884.—Typhoid Fever, about 342 cases, mortality 57.
1885.—Death-rate 17·9 (lowest yet recorded).

The Black Death of 1349 has been shown by a recent author to have fallen with the most signal malignity upon the counties of East Anglia. Its ravages, however, extended to the whole of the kingdom, and in the City of York "it raged furiously from about the Ascension to the feast of St. James the Apostle." (April to July.) Seemingly, three-fourths of the parish priests in York lost their lives in this pestilence. Careful writers estimate that more than half the entire population of the country died. The far-reaching effects of this mortality upon the economic history of England, have only come to be fully recognised in recent years.

Drake, the historian of York, calls the plague of 1604 the last that visited the City, but this is incorrect. There was a visitation in 1631 which possesses features of special interest in con-

nection with the purpose of this paper, from its ravages having been circumscribed by the energy of the local authorities, acting under the strong hand of the President of the North, Thomas Wentworth, afterwards Earl of Strafford. "You have here, under his Majesty," said Wentworth, addressing the Lord Mayor (Robert Hemsworth), "the charge and government of this people, which is to be required at your hands, both before God and man, more especially by myself and this Council, as persons trusted in chief and accountable as well as yourselves; and, therefore, in discharge of my own, not duty only to my master, but my affection also to this town, I do expect that you punctually observe these orders following. Withall, I must tell you plainly, I will inform myself very diligently how they are observed and executed, and shall proceed severely to punish your negligence and others disobedience of them; and that shall Wilson, the chiurgeon, in particular smart for, when it may be he little dreams of it. These are not things to be jested withall."

How the policy of "*thorough*" breathes through every sentence of this letter! The directions which follow were chiefly aimed at preventing the spread of contagion by the isolation of individuals, households, and infected districts. Offenders against the regulations were "soundly whipped," set in the stocks, or heavily fined. Dogs and cats were slaughtered, as supposed to carry the infection. Houses were cleansed. Infected clothes were burnt. The prompt burial of the dead was enforced. The medical remedies were according to the knowledge of those days.* In general terms it may be said

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* Precepts prescribed by learned and approved physicians:—

1. "Let those poor people who are afraid to be infected by being employed about the sick, eat butter and bread, with sage, sorrell, or garlicke pilled, in the morning before their employment.

2. "Let them put into their drink ginger sliced, and steep in it the tops of wormweed, first washed and burnt.

3. "Let them shut in their mouths, lettwall, or angellico for want of it, or gentian.

4. "Let them tie upon a stick, poise wise, a little piece of sponge well dipped in white wine vinegar, camphorated, which they may have at the apothecaries.

5. "Let the infected house be perfumed with the perfumes of tar, pitch, or rosin, or juniper wood, and also all their clothes; also let them perfume their houses with vinegar, or rosemary, or bay-leaves.

6. "If any botches, or plague-sores arise, let them use either of these medicines to draw them to a head, and to ripen and burst them, viz.:—Take the roots of white lilies, roast them well in a good quantity of sorrell lapped in a wet paper; then stamp them, and apply them hot to the swelling, and let it lie too twenty-four hours,

the remedial and preventive measures enjoined are similar to those so graphically described by Daniel Defoe in his famous story of the Plague in London (1665). The principal mortality in the York plague of 1631, was outside the walls, in the parish of St. Lawrence. In the City itself the deaths were not numerous. The exemption enjoyed made the citizens very grateful to Wentworth for the singular energy he had put forth on their behalf. A full account of this outbreak of plague, from the pen of the late Mr. Davies, will be found in the report of the Yorkshire Philosophical Society, 1873. It is a suggestive illustration of the successful application of municipal authority, to the furthering of the public health according to the methods of the seventeenth century.

In the early years of the next century, we learn from an essay of Dr. Clifton Wintringham, that the deaths in York exceeded the births by 20 per cent., and annually amounted to about 1 in 22 persons—45½ per 1000. Small-pox, measles, influenza, and malarian fevers, were often epidemic. As the years of the eighteenth century rolled by, the health of the City markedly improved. In 1777, Dr. White, of York, communicated a paper to the Royal Society, in which he gives particulars of the mortality of the previous years. This had now fallen to 36 per 1000, and for the first time for centuries, as Dr. Laycock believes, the births exceeded the deaths. Dr. White attributed this improvement to the widening of streets, better paving, and the construction of new drains, by which the rain water escaped more rapidly, making the houses drier and cleaner. An important event had been the construction of the weir across the Ouse at Naburn, in 1757, by which the river ceased to be tidal at York, and the banks, which had exuded malarian vapours at low tide, were henceforward always under water.

The amelioration in the health of the City continued to advance

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or apply fresh if need be. But be sure to burn the plaister so taken off, in the chimney fire. Or this: Take a quantity of leaven, a handful of mallows, of sorrell as much, of scabious as much, figgs ten, two injons pilled and sliced; let all these be boiled in old ayle until they come to a soft pultis; stamp it, and apply it hot to the place, thick spread, and this renew every twelve hours, burning it after it is taken off as before said. They may drink, (if they can get it) whigg or buttermilk, but not wey. All the above written directions serve as well (or more proper) for the infected, as for those who are not.

"Mr. Slinger, the apothecary, was desired to make plaisters to apply to the inside of the thighs of such as are in danger of falling sick of the infection, which is thought to be very good for drawing out the malady and malignity of the disease."

throughout the long reign of George III., and that of his successor, and as Dr. Laycock says, "when the epidemic cholera first appeared in England, in 1832, the sanitary condition of York was still low, although when compared with that of the previous century, it was improved to an extraordinary degree."

Dr. Laycock gives the following table of the rates of mortality in York in the eighteenth century. Having regard to the imperfect registration of the period, the figures must be received with some caution.

TABLE *showing the progressive improvement in the health of York since the commencement of the last century.*

PERIOD.	No. of Deaths.	Population.	Per-Centage of Persons Dying *under* 5 Years of Age.	Per-Centage of Persons Dying *above* 5 Years.	Per Centage of Persons Buried aged above 70.	Average Age of Persons Buried.	Inhabitants to one Death.
*a*1728 to 1785	3,486	10,800	......	......	......	......	21·77
*b*1770 to 1781	...	12,798	38·6	61·3	16·5	28·34	28·22
1781 to 1791	4,388	14,079	37·92	62·08	14·67	30·52	32·08
1791 to 1801	4,991	16,145	37·13	62·87	14·44	30·64	32·33
1801 to 1806	2,538	17,181	35·83	64·17	13·54	29·36	33·84
1806 to 1811	2,592	18,217	37·30	62·70	15·55	30·90	35·72
1811 to 1816	2,395	19,502	33·84	66·16	17·71	30·47	40·70
1816 to 1821	2,557	20,787	35·88	64·12	16·62	31·4	40·56
1821 to 1826	2,643	23,523	36·23	63·77	15·82	32·56	44·51
1826 to 1831	3,033	26,260	36·87	63·13	13·04	29·39	43·30
1839 to 1841	2,398	30,152	42·16	57·84	......	32·21	37·77

*** The average annual mortality of each of the periods in this table, is considered as representing the mortality of the last year of the period, on the population of which, the ratio of persons living, to one death annually, is calculated. The percentages are from 26,000 deaths in the parish registers.

a. This estimate is on data from "Drake's History of York."

b. From data published by Dr. White, of York, in the 72nd volume of the "Philosophical Transactions."

The outbreak of cholera in 1832, stimulated many sanitary measures, carried out at that time by the City Commissioners, whose powers were subsequently vested in the Corporation. In 1850, the water supply drawn from the river Ouse was enlarged and improved by filtration. In 1853, an important Sanitary Improvement Act was obtained, by which the sewage discharging itself into the river Foss, was intercepted and taken into the Ouse. This costly undertaking, to defray the expense of which a special rate was borne by the citizens for 30 years, is believed to have been attended by excellent results. In 1872, the Corporation appointed a Medical Officer of Health. It has subsequently erected Public Baths and a Fever Hospital. Concurrently with these measures, the annual death-rate has been lowered nearly 2 per 1000 in the last 10 years, and the mortality of

the City is now as low as the average of urban communities in England and Wales. Still it is higher than could be desired. In 1884, an outbreak of typhoid fever excited considerable apprehension, and since that time the drainage system of the City has received much consideration from the Medical Officer of Health, and is at the present time the subject of a special inquiry by direction of the City Council. I subjoin the annual statistics of births and deaths in York since 1874, also a Table showing the mortality from certain specified diseases, for the same period, taken from an exhaustive report by Mr. North, presented to the Council in February, 1885, which contains full information on the recent sanitary state of York. (For Table see page 205.)

We will now leave the City of York with its comparatively small population, and glance at the recent experience of the great commercial community living on the banks of the Clyde.

The City of Glasgow can present a particularly interesting record of the sanitary benefits its inhabitants have enjoyed, by the intelligent vigour of its municipal government. Amongst the agencies which have ameliorated the condition of Glasgow, its unrivalled water supply stands prominent. Upwards of £2,000,000 (£2,202,789) have been spent in bringing the water of Loch Katrine to the 750,000 people living in Glasgow. But this outlay (large as it sounds), has secured a bountiful supply of water almost absolutely pure, clear to the uttermost and without colour, at a less cost to the community, than that of most of the great cities of the Empire. Five and twenty years ago, it was estimated that through the purity and softness of this water, the Glasgow people saved £40,000 per annum in soap and tea alone. The Corporation of Glasgow published last year a volume of 304 pages, drawn up by the City Chamberlain, James Nicol, Esq., giving in detail the vital, social, and economic statistics of the City.* These figures, says Mr. Nicol, show that in the ten years ending with 1884, 600 lives per annum were saved in Glasgow, which would have ended, had the people died as fast as in the ten years ending with 1874. The whole lessened mortality of the decade must represent a population, now living, equal to that of the town of Malton. This diminution of mortality has largely resulted from the specific measures taken for the prevention of fever since 1869.

* Other Corporations might do well to follow the example of Glasgow in publishing facts relating to their administration. The inhabitants of a locality are often very ignorant as to what their municipal rulers are doing. Great service may be rendered to sanitary work by keeping the public mind informed, through the local newspaper press and otherwise, as to the measures which a municipality is carrying out, the reasons for them, and their results when finished. Books like this of Mr. Nicol's nurture an intelligent local patriotism.

About that time the Health Committee addressed themselves vigorously to ascertain the causes of the prevalence of fever, and if possible to remove them. In 1869, 1256 deaths were registered from different kinds of fever, typhus claiming 970. In the last four years the deaths from fever have never reached 300, and for ten years the annual mortality from typhus has been under 100. Mr. Nicol tells us that it was clearly shown that insanitary conditions originated the pestilence, and that once generated it spread rapidly from house to house, from court to court. Isolation, followed by fumigation, was found to be the surest way of preventing the spread of the fever. The compulsory powers for securing this, and carrying out other sanitary measures were put in operation. At first the vigour of the health officers excited opposition, but this was surmounted, and now every one recognises their high aim and submits to their administration.*

Mr. Nicol supplies the following statistical information as to the fever mortality in Glasgow for the past eighteen years:—

GLASGOW.

Febrile Mortality in past eighteen years.

YEAR.	Typhus Fever.	Enteric or Typhoid Fever.	Relapsing Fever.	Simple Continued Fever.	Infantile Remitting Fever.	Rheumatic Fever.	Total of each year
1867	497	202	7	16	26	17	765
1868	367	229	5	16	41	13	671
1869	970	221	12	9	31	13	1256
1870	544	152	113	12	27	6	854
1871	286	180	247	19	25	15	772
1872	161	206	37	5	20	11	440
1873	79	285	5	12	24	18	423
1874	114	202	7	10	11	20	364
1875	96	252	3	11	19	24	405
1876	82	196	8	14	22	25	347
1877	77	170	2	1	11	12	273
1878	50	198	2	7	9	18	284
1879	58	134	...	10	9	32	243
1880	43	279	1	19	6	40	388
1881	50	175	...	11	12	44	292
1882	32	177	1	9	6	40	265
1883	53	176	1	13	1	47	291
1884	32	199	...	9	5	34	279
Total of 18 Years.	3591	3633	451	203	305	429	8612
Average of 18 Years.	199	202	25	11	17	24	478

* Vital, Social, and Economic Statistics of the City of Glasgow. Robert Maclehose, p. 46.

If time had allowed, it would have been interesting to have described some of the other works which have been carried out by the Corporation of Glasgow. Something of the magnitude of its administration can be surmised from the growth of the municipal revenue from £15,340 in 1844, to £1,186,278 in 1885. I cannot, however, stop to speak of the removal of old and dilapidated property, of the elaborate system by which the City is cleansed, of the parks, markets, or libraries, or of the wonderful growth in the navigation through the deepening of the Clyde. These are characteristically set forth, in much detail, in the volume I have referred to. Whilst her municipal government is thus administered, Glasgow will have no need to fear that the motto of the burgh will grow obsolete —"Let Glasgow flourish."

Visitors to Birmingham at the recent meeting of the British Association, were furnished with a particularly well-written hand-book of information about the capital of the Midlands. From the preface I copy one paragraph referring to the achievements of the Corporation, in respect to the health of the town:

"Immediately after the passing of the Public Health Act, 1872, the Borough was constituted an Urban Sanitary District, and the Council, as the Urban Sanitary Authority, set itself vigorously to the work of improving the public health. A Borough Hospital, for the treatment of small-pox and scarlet fever, was established in 1874. The Public Health Act, 1875, indirectly removed, for sanitary purposes, the limit on rating powers to which the Council were obliged to submit in their Act of 1851. By the zealous labours of the Health Committee, and the liberal application of the pecuniary resources placed at its command by the Act of 1872, the death-rate has been reduced from 24·8 per 1,000 in 1874, to 19·1 in 1885, although the mean density of the population has increased in the same period 20 per cent."

It would be easy from the history of other English municipalities, to relate achievements not less striking than those I have drawn your attention to. But this is unnecessary and might be tedious. The experience of York, Glasgow, and Birmingham, may be taken as representative examples, all showing how much is in the power of local governments to effect for the health of the people. We will now turn from the records of the past, to consider the means whereby in the future municipal governments may best promote the public health. For it would be a great error to suppose they have reached the limits of their powers, although when one reviews the sanitary history of our ancient cities, or the more recent achievements of our

foremost municipalities, one is struck with the great advance which sanitary knowledge has made. I hardly exaggerate in saying that sewage has become one of the most popular questions of general conversation. The widespread interest now taken in sanitary matters meets you in unexpected quarters. Visitors to schools and other public buildings, will often exhibit as much interest in the drains as any part of the structure. In the recent political discussions on the government of Ireland, the high death-rate of Dublin has done duty as an argument against giving increased powers of government to people who did not employ those they already possessed to keep their own population in health. Localities have learnt that disease and death are costly. A high death-rate is a distinct loss to a community. The British watering-places vie with each other in endeavouring to show from statistical data, their own superior salubrity. One corporation has, we believe, circulated instructions for the proper bringing up of infants. Another made an inquiry into the causes of juvenile mortality, when the registrar's figures disclosed deaths in excess of those of competing watering-places, and discovering a reprehensible habit amongst its constituents of feeding infants on kippered herrings and gin, endeavoured to dissuade parents from supplying a diet so injurious to their children, and so detrimental in its results to the good name of the town. When an outbreak of fever occurs, the popular voice at once demands the presence of an inspector to track out the cause, and public meetings are held to incite the local authorities to increased vigilance in cleansing the streets, flushing the drains, and removing nuisances. A former generation would have marked the cessation of a pestilence by erecting an altar to an unknown god. It is an immense gain to the cause of sanitary science that the popular mind has been imbued with a belief in the connexion between many forms of disease and removable causes. A great deal has been achieved when popular opinion has been enlisted on behalf of the measures needful for the public health. When the people see that these measures are for their own good, and the good of their children, our popular municipal governments become the strongest of all governments for the attainment of the desired ends. From the sanitary standpoint they realize President Lincoln's ideal—government of the people—by the people—for [the health of] the people. To an intelligent population, its municipal government becomes the authoritative expression of its wishes in sanitary affairs. Hence the great importance of the *personnel* of our municipal bodies. If the connexion between a healthy population and good municipal government were yet more generally recognised, a more widely

diffused and a more intelligent interest would be taken in the selection of councillors than is now the case. This would show itself both in the choice of candidates, and in inducing fit men to be willing to take the appointment. In some localities municipal office is honoured, and is an object of ambition to able and educated men. In other places, it is too much the fashion in the educated circles to reckon the office of councillor or alderman, *infra dignitatem*. When a corporation has been elected how may it best serve the sanitary interests of its constituents? You may assume that all its members would rather see their locality healthy than unhealthy. It is also safe to assume that there will be a considerable number who have but little knowledge how this is to be brought about. The main work of a corporation is done by its standing committee. You want public spirit amongst its members, and a sense of responsibility to the population they represent, which shall secure upon the health committees the presence of those members who have special acquaintance with the subject. Then beyond this, I should attach extreme importance to the selection of your permanent officials. Unless a corporation is well sustained by its officials, its work will fail. Why? Because a corporation and its committees are always changing—but its officials are permanent. You may have the most intelligent committees. They may arrive at the wisest conclusions. These may be recorded on their minutes. The committee breaks up and disperses. When it meets in a fortnight's time, it may be to find its directions have not been carried out at all—or carried out too late—or in an imperfect manner. This is what constantly takes place when the administration of a public body is in the hands of inefficient officers. Then how shall you secure good officials? (1) By paying adequate salaries. (2) By the maintenance of a public spirit in the appointing body, which will demand efficiency as the supreme qualification for appointment. If a corporation selects its health officer—not because he is a man capable to deal with sanitary affairs—but because he is the personal or political friend of a majority, it will but too surely pay the penalty—it may be in years of inefficient work. It is no exaggeration to say the sickness of hundreds of people, the deaths of scores, may follow as the direct or indirect result of one unsuitable appointment. You can hardly be too careful also in the selection of your subordinate officers in the same department. These men obtain a specialised knowledge of questions of drainage, often exceeding that of able architects. I have personally known architects' plans most faulty, which before their execution have been made good by the suggestions of nuisance or buildings inspectors. These

men should work under kindly efficient oversight. Temptations are placed in their way to pass scamped or incomplete work. England expects every man to do his duty, but unfortunately there are always some English builders who do not know their duty, and some it is to be feared who know it, but do not wish to do it. In one nice looking house, not fifty miles distant from where we are now assembled, a soil pipe was recently found to have been conducted into a rain-water cistern used for household purposes. In a street known to many present, the drainage had been arranged on the intelligent supposition that water is accustomed to run up hill. Now these are the details which require ceaseless vigilance, and to which no corporation can attend except through its officials. When you get efficient and conscientious men in these departments, even if you pay high salaries, they may be extremely cheap to a community. Fill them with inefficient men, and if you paid them nothing, they would be intolerably dear.

The difference of a few pence in the rates of a locality makes but little difference to the majority of the population, in comparison with the cost of disease. The abolition of a 6d. rate would be a great event in municipal finance. It would save the majority of ratepayers 6d. to 1s. a month. But an outbreak of preventable disease quickly costs the poorest many sixpences and many shillings, irrespective of the sorrow and suffering that follow in its train. Yet, all public expenditure, even in the interests of health, should be thrifty and economical. Lavish expenditure may go hand in hand with inefficient administration. And it should never be overlooked that a population is always liable to forget what it is receiving from its sanitary guardians, whilst the cost of their services it never forgets. The averted fever, the escape from small-pox, are not thought of : the rate collector always asserts his presence. If his visits become too frequent and too onerous, they are liable to provoke a reaction against measures urgently required for the public weal.

I have spoken hitherto, chiefly of municipal administration in relation to health. There is outside this the wider question of general municipal policy. Should a municipality limit the sphere of its activity within the narrowest limits prescribed by the general law of the country, or should it take a wider and more comprehensive view of its responsibilities? Experience indicates, I think, rather decisively that the latter is the wiser policy. If the work of a corporation is small it excites but little public interest. It is liable to fall into the hands of an inferior class of men. On the other hand, where the work is important and interesting, it attracts to it able men. It is

difficult to impress the popular imagination with small questions of drainage, inspection of nuisances, the prevention of adulteration—most important as these things are. But where a municipality concerns itself in addition with providing parks, or places of recreation for the people, beautifying the public roads with trees, as well as cleansing and watering them, taking charge of the water supply as being a requisite of life, to be so administered as shall promote the health of a population rather than the profit of shareholders; where it has charge of great public libraries open to the entire population, in which amongst other literature, the best works upon sanitary science lie open before the poorest citizen equally with the wealthiest; where baths, wash-houses and fever hospitals are maintained for the enjoyment of the healthy and the recovery of the sick—though these things cost money the people feel that they are their own property, and it is found that such a policy best promotes the material interests of the locality, as well as the health of its inhabitants.

In the formation of sound public opinion on these subjects, the annual gatherings of this Sanitary Congress may be of very great use.

Before concluding, I must briefly advert to one matter of cardinal importance, in which municipal life touches the public health to some extent directly, and to a still greater extent indirectly. The health of the British people probably suffers more from their intemperance in the consumption of alcoholic beverages, than it does from bad drainage, impure water supply, or insanitary buildings. Municipal life connects itself closely with the social life of the community. The drinking of healths is a popular department of municipal activity. Multitudes have ruined their own health through drinking the healths of other people. Sir William Gull says:—"A very large number of people in society are dying day by day poisoned by alcohol, but not supposed to be poisoned by it." Sir Andrew Clarke says:—"I looked at the hospital wards to-day and saw that seven out of ten owed their disease to alcohol." It has been ascertained that the class of the community most liable to the frequent taking of alcoholic liquors—licensed victuallers and innkeepers—are amongst the most short lived. They die in the ratio of two to one of the Protestant clergy, and as five to three of grocers, game-keepers, and farmers. In view of facts like these, which are capable of indefinite extension from the records of sick clubs and insurance offices, no one interested in sanitary science can rightly be indifferent to the claims of the temperance movement. The progress it has made has already lessened the amount of sickness and death in the community, but the

continued prevalence of intemperance is every day carrying many victims to the grave. Opinions will still continue to differ how this giant evil may best be grappled with. The advocates of total abstinence believe they have no occasion to be ashamed of their faith and practice, and the adherents of strict moderation can advance weighty arguments in support of their position. It is no part of the purpose of the present paper to discuss the respective claims of abstinence and moderation, but it would have been a grave omission to have made no reference to a subject at once so closely related to municipal government and to the public health. Municipal corporations have considerable power in the appointment of the magistracy, the present licensing authority, and they have a still greater power in influencing the social customs of the community. The members of corporations who would worthily fill their part as custodians of the public health, will not overlook their responsibilities in relation to the use of an article, which is practically so great a foe to the welfare and happiness of mankind. I gladly bear testimony to the increased interest that has been shown of late years in this subject, and to the marked improvement in the customs of society in relation thereto.

The argument of the present paper has been so simple, that it is unnecessary to employ many words in summing up. The facts adduced clearly show how strong is the influence which municipal governments can exert on the health of communities. The great improvement in the public health, which has been in progress for a long period, and is continuous to the present time, is to no inconsiderable extent attributable to the vigilance of our municipal governments. At the same time, the measure of past success should only be an encouragement to further and more intelligent labour in the future. I have endeavoured to indicate both the general municipal policy and the character of the administration, which promises the largest harvest of useful results in future years. The drift of public opinion in this country is favourable to enlarging the powers of local authorities. Should this increase of power be granted, and should it be exercised on the lines I have endeavoured to lay down, we may anticipate the best results to the health of the British people; —and whilst this paper and the proceedings of this Congress relate to physical health, the subject grows in importance, when it is remembered how intimate is the relationship between physical, intellectual, and moral health.

[*For discussion on this paper see page* 218.]

TABLE *showing Births, Deaths, Birth-rate, Death-rate, and Deaths from Zymotic Diseases in the City of York for the Twelve Years ending* 1885.

Year.	Estimated Population.	Total Births.	Total Deaths.	Deaths under One Year.	Deaths under Five Years of Age.	Deaths from											Deaths under One Year to 1,000 Births.
						Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	Typhoid and other continued Fevers.	Diarrhoea.	Total deaths from the Seven Principal Zymotic Diseases.	Birth-rate.	Death-rate.	Death-rate of Urban Districts in England and Wales.	
1874	45,443	1604	1041	293	440	..	20	21	4	25	18	70	158	35·2	22·9	24·2	183
1875	46,005	1572	1091	285	418	..	3	9	2	49	29	73	165	34·1	23·7	24·2	181
1876	46,575	1644	906	241	350	1	3	14	5	13	17	82	135	35·2	19·4	22·6	146
1877	47,151	1691	1048	263	411	..	30	46	7	3	6	53	145	35·8	22·2	21·8	155
1878	47,735	1732	1070	313	477	..	2	19	5	35	12	90	163	36·2	22·4	23·4	180
1879	48,326	1664	1094	265	399	..	7	32	..	26	10	37	113	34·4	22·6	22·1	159
1880	48,924	1657	1097	294	469	..	17	22	2	23	18	152	234	33·8	22·4	21·9	178
1881	49,530	1634	943	232	351	..	1	30	6	15	23	44	119	32·9	19·0	20·3	141
1882	50,143	1627	1066	311	489	..	44	22	3	37	14	73	193	32·4	21·2	21·2	191
1883	50,764	1620	1027	257	351	..	..	14	4	11	17	53	99	31·9	20·2	20·8	158
1884	51,392	1668	1102	305	441	..	38	38	2	4	57	76	215	32·4	21·4	20·9	182
1885	52,029	1521	936	232	352	..	3	8	1	46	7	30	95	29·2	17·9	..	152·5

NOTE.—The figures given in this Table refer to the City *before* the Extension of the Boundaries, and do not include any part of the added area.

On "An Account of an investigation into the classes who administer the Public Health Act," by T. HARNETT HARRISSON, Assoc.M.I.C.E.

OPINIONS expressed at these Congresses as to how the Public Health Acts work and how they fail to work, have led to an attempt being made to obtain some further information about the classes who administer them. Discussions on the subject seem to shew that the Public Health Acts are fairly efficient, and that the officers appointed under them are mostly good ones. But that these officers are often hindered and thwarted in their efforts to carry out the duties to which they are appointed, and that they are so hindered and thwarted by a system that prevails, to some extent, in the majority of places where Boards of Health are established.

This system when it gets its right name is called "jobbery," and jobbery means the doings of men who use their official position for, and turn official action to, their own advantage. The initiated in such matters, know that there are men who get elected as members of sanitary boards for the sole purpose of practising jobbery, while some consent to the practice of it, in obedience to pressure put upon them by other members or by persons outside to whom they are bound by monetary or similar interests. There are a large number of men supposed to be elected to their positions to work for the "public good," who if they understand the phrase "public good" at all, would regard acting from such a motive as simple stupidity; their whole philosophy is summed up in the words "*number one*," and their action is regulated by that single idea.

There are, also, many honest public spirited men elected to sanitary boards, having every wish and intention to further all that is good, but they often find themselves in a minority, and either remain to fight a hopeless battle against jobbery or retire in disgust. There are also some sanitary boards which carry out the powers given to them by the Public Health Acts, in a manner beyond criticism or praise.

The framers of these Acts do not seem to have sufficiently provided for the fact, that "there's a deal of human natur' in man." If it were not for this human nature, laws would not be required at all, but since men have to administer the laws made to counteract their own imperfections, provision for the

proper administration of laws is quite as necessary as making the laws themselves.

The object of this enquiry was to discover how far the absence of such a provision has been taken advantage of by those whose self-interest is opposed to the operation of the Public Health Acts.

It was thought that a man's business and position in life are excellent indications of what his worldly interests are with regard to such a matter as that under consideration, and that his interests are good guides as to what his line of action will be. With the object, then, of obtaining information as to the business and position in life of the administrators of the Public Health Acts, circulars were addressed to the Medical Officers of Health of eight hundred of the urban sanitary authorities of England and Wales, asking the profession and position of the members of their Boards, and for any remarks they would kindly make.

Of these 800 circulars, 202 were returned with the information asked, 29 were returned without any information, and 569 are now languishing in the oblivion of waste-paper baskets.

Although it is to be regretted that 598 medical officers of health, no doubt for very good reasons, declined to reply, the 202 who gave the information sought did so with great courtesy, sometimes accompanying it with remarks of considerable pith and offers of further information. To this faithful few we owe our best and most sincere thanks, as it is thought, that, from the returns they made, and the remarks which in many cases illuminate them, interesting information and some food for reflection may be gathered.

In the case of 37 circulars sent out, the additional request was made that the letters P. O., meaning property owners, should be placed opposite the professions of the members of the boards.

It is to be regretted that this request was not made in the case of all the circulars, as the returns made having this addition yield the most valuable information. The 202 sanitary authorities of which returns were made are composed of 2796 members, and these are readily divisible into 22 classes, and of these 22, there are only 9 classes numbering more than 50, but it will be seen that the administration of the Public Health Acts is virtually in the hands of four or five classes. In order that some idea may be formed, as to the attitude of these classes with regard to sanitary progress, it is thought that the most profitable course will be to consider them separately.

The nature and effect of the action of builders upon Boards of Health is pretty well understood, and is almost universally objected to by sanitarians, on the ground that their building operations cannot be controlled by the sanitary officers, since the

sanitary officers in this case have to control the sanitary (or unsanitary) authority, the servant to control his master, and this position of things of course applies to all other cases where members of such boards oppose sanitary work.

The builder members of sanitary boards generally get elected in order that they may build cheaply and in defiance of the law. The result is that the public health is often sacrificed in order that a paltry sum of money may be retained in the pockets of men appointed to promote public health. A body of men who are elected by their fellow men to save life turn round and kill their electors for a small fee. And one is inclined to say it serves the electors right, since the public is entirely responsible for the presence of builders on Boards of Health and for the kind of dwellings they erect. It cannot be said of the speculative builder that he is an instance of the survival of the fittest; he, however, seems to be a product of natural selection, since he has been developed to his present state of imperfection by surroundings which he has accepted as being of material advantage to himself. People are never tired of abusing the speculative builder who has erected their defective dwellings, but the public have not only themselves created him, but have proceeded to elect him as the guardian of their health. When people are willing to give a fair rent, purchase money, or mortgage money for a well-designed, well-built, and sanitary house, of a size in proportion to the price, the speculative builder, as we now know him, will die out, and a better stamp of man will take his place. What people now want in a house is display, not a convenient or healthy home.

It is thought that a great deal of education will be required before sound sanitary houses will be selected rather than showy, cheap, and nasty ones of larger size. At present the jerry builder flourishes upon the snobbish wish of Mrs. Roe to out-snob the snobbishness of Mrs. Doe. Although sanitarians look upon builders as such great obstructionists, they do not appear, from the returns obtained, in great numbers upon Sanitary Boards. Out of the 202 from which returns were obtained, 101, or one-half only, are blessed with their presence. Out of 2,796 members of Boards of Health under consideration, 212 of them are builders, or about $7\frac{1}{2}$ per cent. There are only $4\frac{1}{8}$ per cent. of builders serving upon Sanitary Boards returned as property-owners. As we know he builds to *sell*, and some of his purchasers belong to classes largely represented with him upon Boards of Health.

The following are remarks made by Medical Officers of Health:—

1. "I feel a deep interest in the work of sanitation, and have

pleasure in giving the information you seek. I deeply deplore that builders should obtain seats on health boards. I deeply deplore the terrific rate of infant mortality in my district, and would help in any way possible to reduce it."

2. "Of course builders of cottage property are well represented."

Of all classes serving as members of sanitary boards, the shop-keepers are by far the most numerous. They appear upon these returns to the extent of 30·84 per cent. of the whole number. It would not at first be thought that as a class they are directly interested in opposing the Health Acts. But they appear as property owners in the third degree or to the extent of 11 per cent. of their number. This class, perhaps, is the least independent of any; they rely almost entirely upon popular favour and goodwill for their prosperity in life, and are, it is thought, more than any class under the influence of those who can be important friends or damaging enemies. It is to be expected that they would from these motives take at least a negative position with regard to any cause requiring both outlay and fighting to secure its advancement. There are, however, many among them who are offenders against the Health Acts. Cottage property is a favourite investment with the shop-keeping class, and the thriving ones frequently drift into the gentlemen class, when they own enough of it to live upon the rentals. To become a member of a local board is a cheap means of gaining importance, and when the envied position is attained, profit comes with the popular favour that can readily be achieved in a money-getting and money-keeping community, by opposing all work, good or bad, that involves outlay and higher rates. But to men of independent position these things have no charms; they are, on the contrary, repelled by the fact that small jobbers are attracted.

The following are some remarks by Medical Officers of Health:—

1. "It is impossible to work, one is always under the thumb, and subject to, the spites and spleen of the pettifogging men who form the Board. The appointment ought to be entirely in the hands of the Local Government Board. Then one could do good honest work without being kicked out every twelve months."

2. "The men who form the Board are all small in every sense of the word, none of the leading men will sit on it."

3. "There has been a great falling off in the social status of Sanitary Authorities since the passing of the Public Health Acts in 1875."

4. "As for the members they consist of tradesmen of the

town, who are chary of spending a penny in the way of improvement."

5. Where there are 16 shop-keepers out of the 24 members, the remark is:—"I do not believe that the very smallest fraction of those constituting the Board do so for the sake of sanitary matters, it is more to get their names before the public, and have the handling of public affairs. The Medical Officer's Report is read, and no discussion is ever made upon it. The subject of their meeting is generally some wrangle about the Town Hall clock, or other equally absurd subject."

6. "My district is not so sanitary as it should be, there is no doubt it is useless to recommend as the Board never carry out my suggestions."

7. Where there are six shop-keepers and a manufacturer out of nine members, the Medical Officer of Health says, "Personal interest always above sanitation."

8. In a case where the chairman is a baker, the remark is,—"He is a business man and anxious to carry out sanitary improvements."

9. Where the Board is composed of 16 shop-keepers, 3 builders, and 2 building tradesmen, the Medical Officer of Health says—"Here as elsewhere really intellectual and intelligent men keep entirely aloof from municipal affairs."

10. In a board of 16 the Medical Officer of Health marks 6 and says,—"Those marked are very good members. The majority are not men of any position in the town. They have gradually withdrawn."

11. "Unless Boards of Health are composed of men of independence and free from local pressure, I am convinced that it is impossible to work any great sanitary reform."

Manufacturers are very strongly represented upon sanitary boards, they number 17½ per cent. As a class they may it is thought be fairly ranked with those whose interests directly clash with sanitary work. Among their numbers are chemical manufacturers, tanners, bone boilers, fellmongers, glue makers, manure makers, fat refiners, brick makers, dye makers, candle makers, soap boilers, gas makers, and others too numerous to mention, the nature of whose operations are such as to pollute our water, and load the air of our populous places with noxious gases and smoke.

The constant litigation brought about by the nuisances they create, and the special provisions in the health Acts made by Parliament to regulate and control their works, is pretty good evidence that manufacturers are not a class calculated to make good administrators of the health Acts; while on the contrary they are eminently fitted to make formidable enemies to sanitary reform when so inclined.

They are a very powerful class, in that they are wealthy, they pay the working population of towns their wages and command votes. They can arrange that the medical officer of health shall or shall not act as doctor to their workmen.

They are probably among the worst and most numerous offenders against the public health.

But we find that next to the shop-keepers they are the most numerous of all the classes serving upon sanitary boards.

They are also of all classes the largest property owners, 16 per cent. of them appearing under that head, and their property largely consists of cottages inhabited by their own workmen.

Is it not natural that this class, considering the great stake generally involved, should use their power for the purposes of self-defence? If the builder's interests are sufficient to make him so potent an enemy of sanitary work, what is likely to be the effect of the enormous interests of the manufacturers?

Remarks of Medical Officers of Health :—

1. "This Health Committee takes very little interest in sanitary matters. It seems to be the opinion of the Committee that the less fœcal matter in tanks is disturbed the better, because it stinks most when it is disturbed."

In one case there are nine manufacturers out of twelve members, and the remark is :—

2. "The only difficulty we have in one district is from the agent of large works, who refuses to carry out improvements in the sanitary condition of houses of his company. The chief of the rates come from this company."

3. "Clauses as to smoke not enforced; members, who are chiefly manufacturers, will not agree that it is injurious."

4. "The chairman of the Sanitary Committee is a fell-monger."

Gentlemen appear from the returns to serve on Health Boards to the extent of about $11\frac{3}{4}$ per cent. The word gentleman formerly meant a man of gentle or noble birth—one who, not being a member of the nobility, had a right to bear arms.

This definition has, however, gradually widened, until to-day a retired scavenger would feel deeply wounded if he were not spoken of or introduced as "this gentleman," so that the appellation, as used by the majority, has ceased to be a complimentary one, except that it is intended to convey that the man to whom it is applied can afford to live without working. And this is what it means to a large extent in the case of these returns. It does not, however, mean that jobbery shall be considered as work, or that the jobber forfeits his right to the title. All the members of Health Boards have been classed under this head who live upon their means, whatever may have been their former occupation. They largely consist of retired trades-

men, and 13 per cent. of them are property owners. It would, of course, be absurd to imply that there are not many among them who are gentlemen, in the best and highest sense of the word, and who, as members of Sanitary Boards, work solely for the public good.

But, as a class given in these returns, they are, it is thought, not generally to be considered the friends of the Health Acts. They are of all classes except one the largest property owners.

Remarks of Medical Officers of Health :—

1. "I mean by 'gentlemen' men who have gained a competence and are living on it."

2. In one return the chairman is classed as a gentleman, and a note after his name says, Plumber, now out of business.

3. Opposite one member it says, "Mr. ——, Gentleman—Druggist and Quack—Chairman."

4. "Gentleman, means retired from position in a haberdasher's shop ; holds some very poor dwelling-houses."

5. As you will probably surmise, most of those notified under the term "gentlemen" are retired tradesmen.

Merchants appear to the extent of about 8¾ per cent. ; they are property owners in the fourth degree, or to the extent of 7 per cent. of their numbers, otherwise it is thought that they are calculated to make good administrators of the Health Acts, as being comparatively independent of the immediate locality in which they live, as being good men of business, and to a large extent free from prejudice. The property they own is not generally poor, except in the case of timber merchants, who have to annex that of speculative builders for bad debts. The timber merchant, too, is likely to be to a considerable extent under the influence of the builders.

Taking them as a whole, however, it is thought they make good administrators of the Health Acts.

There are 89, or about 3¼ per cent. of doctors serving upon sanitary boards.

The interest of doctors appears to be that people should neither die or live healthily. The doctors' ideal population, assuming fees to be his first object in life, would probably be one made up of wealthy "chronics," just ill enough to make his attendances necessary, and yet quite well enough to live to a good old age. It has been said that to some doctors their profession is a heavenly goddess, while to others she is only the cow that gives the milk. It is sincerely believed that the majority of them are more or less goddess worshippers, and that the cow-keepers are few. The profession has earned for itself the character of being the most self-sacrificing of all professions, and they are as well in the front as leaders in promoting sanitary

science and the prevention of disease, as they have always been in the gratuitous relief of human suffering.

But professional rivalry does sometimes tell against the Health Acts. There is a very strong opinion that no medical officer of health should, while holding such an appointment, practice his profession in the ordinary way. There is, however, little doubt that taking medical men as a whole, they are among the best administrators of the Health Acts, and perhaps that is why they are so sparsely represented upon sanitary boards.

Remarks of Medical Officers of Health.

1. "The men on the board say things will do when officers report the necessity for removal of nuisances."

2. "I believe if we had more supervision by the Local Government Board by occasional visits from one of their staff to see how work is carried on, and suggest a closer attention to some matters, the officers would be able to discharge their duties more efficiently."

3 "It is a great mistake for a second medical man to be on sanitary committee—they are only obstructive to any progress."

4. "The members are generally elected upon political grounds."

5. "As a cure for these evils, appointment by the Local Government Board of regular sanitarians, who shall make periodical tours of inspection through different townships. These men would be in an irresponsible position."

6. "I have much pleasure in filling up your schedule, as I consider your enquiry a very pertinent one."

7. "The tone of the Committee has been coming down for some years."

8. "I am glad some one is looking into this very important subject."

9. "The Medical Officer is only one voice amongst the many, and he is not a member and has no vote."

10. "The small salary does not compensate for the amount one loses by offending people while doing one's duty."

11. "No matter what reform one may introduce, unless it is palatable to the majority of the Board, who know nothing of the matter and are only influenced by trying to keep down the rates and remain in office, one can get nothing done."

12. "He frequently gets no end of abuse for ventilating such ideas (sanitary improvements). The consequence is the Medical Officer of Health either resigns or, finding it useless, no longer takes the interest he should in the matter, and so nothing is done."

13. "When a serious epidemic comes, the obstructionists are

the first to complain and wonder why such a state of things exists."

14. "The motto of this Board is '*Dolce far niente.*'"

15. "Speaking generally, sanitary boards are slow to move, but they do move, and perhaps as quickly as we could well expect."

16. "In consequence of being medical officer to large works cannot in this case use compulsion."

17. "The mayor and town council constitute the local authority, and they are selected and elected not for any sanitary reasons or fitness."

18. "River still in frightful mess. People generally uncivilized and board very representative."

Farmers appear on the returns in the proportion of $7\frac{3}{4}$ per cent. They are for the most part an independent class, but the surroundings of the farm yard and familiarity with the odours thereof, so grateful to the bucolic nose, and the advantages of an open air life, may perhaps lead to a want of appreciation in the mind of the husbandman of the necessities of those who live in thickly populated places where sanitary improvements are most needed. Four per cent. of them are property owners, that is $\frac{1}{8}$ per cent. less than builders.

Lawyers, of whom there are $3\frac{3}{4}$ per cent. upon these Boards, as men of education and administrative ability, are no doubt often useful members, but as representatives of trustees, mortgagees, and executors, they are largely interested in saving expenditure upon house property, and it is to be feared they are doubtful sanitarians. Speaking of a lawyer, a Medical Officer of Health says:—"He takes a very sensible view of things unless the interests of clients interfere." Another says a lawyer dominates the committee, and throws obstacles in the way of sanitation if expense is likely to be incurred.

Estate agents are represented to the amount of 2 per cent. They must be placed on the side of the goats, while auctioneers, who appear to the extent of about $1\frac{1}{2}$ per cent., must be regarded as questionable sheep.

There are only 33 engineers, or $1\frac{1}{4}$ per cent., and of these one Board has 7 out of 9 members; and the remark of the medical officer is, "This Board is one of the best in England."

The clergy number 23, or $\frac{3}{4}$ per cent.; it is difficult to say why there are not more of them, their presence in such a position could but be good; for as men of culture, and as visitors of the sick and poor, they can well understand the necessity for sanitary work.

There are $1\frac{1}{4}$ per cent. of architects, and the experience of some is that plans can be passed by members of this profession

when serving upon such Boards that are rejected when presented by outsiders.

There are 20 schoolmasters—5 under the head of army, 7 literary, 8 contractors, and 2 registrars of births and deaths.

As a rule, the professions or classes least likely to produce unobjectionable members of Boards of Health are much the most sparsely represented.

Of all men who are directly and selfishly interested in saving life, and who, it might be expected, would be found largely represented on Boards of Health, the insurance or life agents stand first. But, as a matter of fact, there are only 7 of them out of 2,796. Why, it almost suggests itself to one's mind that, considering their very great interest in the preservation of human life and the *enormous* numbers of "life agents" available, that the matter of the public health might be very safely placed entirely in their hands. But if it is astonishing that life agents are so few, what will be thought of the fact that the agents of grim death himself appear among those elected as members of Boards of Health. Men who absolutely live by death, whose business becomes more lively as the epidemic becomes more deadly. Men who would only be expected to be found serving as promoters of a Public Disease Act. Men whose regular occupation it is to carry us from our houses to our last homes feet foremost; who provide for us our "customary suits of solemn black," and whose crocodile tears are charged in the funeral bill. It is a horrible revelation, but of the 2,796 members of Sanitary Boards four of them are *undertakers*. It is thought the undertaker comes appropriately at the *end* of all professions.

From the returns made as to the number of property owners it was found that there were 408 members serving upon the 37 boards; of these 408 members, 251, or about 55 per cent., were property owners.

The greatest number of property owners are found among the manufacturers, the proportion being	16 per cent.
Next come gentlemen who are property owners in the proportion of	13 ,,
Shop-keepers are property owners to the extent of	11 ,,
Merchants to the extent of	7 ,,
Builders about	$4\frac{1}{8}$,,
Farmers	4 ,,

Or a total of 55 per cent. of property owners, upon the 37 boards of which returns were obtained.

This analysis shews that the three most numerous classes serving upon sanitary boards, are also by far the largest property owners, 40 per cent. of the total of 55 per cent. belonging to these three classes, namely, the shop-keepers, the manufacturers and the gentlemen. It is not for a moment suggested that all these owners of property are landlords of unsanitary dwellings. But there is surely some meaning in the fact that by far the greatest proportion of property owners, are to be found among the classes most numerously represented. There are hardly two opinions as to whether builders do or do not make good members of sanitary boards, but if similar motives to those of the builder actuate other men, then it looks bad for sanitary boards that they are made up of 55 per cent. of property owners. The speculative builder erects the unsanitary dwelling, but when he has sold it to the manufacturer, the gentleman, or the shop-keeper, are the owners of these same dwellings not just as likely to resist any attempts to make them sanitary as the builder would be if he had not sold them? And there are forty members of these classes who are property owners, to every four builders. No doubt property should be represented in some form upon sanitary boards, or perhaps there might be cases in which enthusiastic sanitarians would want whole towns rebuilt.

Remarks of Medical Officers of Health.

1. "Mr. —— owns a large amount of house property of all sorts, and is slow to improve his own property and anxious to avoid expenditure on public works."

2. "In the cases where property owner is mentioned, the owning of property is almost as much a business of the person as his other trade, if he has one, and sometimes more so."

3. "9 out of 12 are property owners."

4. "All of them are, I believe, owners of property."

5. "In many cases all are property owners except one or two."

6. "One member owns a considerable quantity of property of a very inferior character, but still keeps it in fair sanitary condition."

7. "Of course owners of cottage property are well represented."

8. "I ceased to be Medical Officer of Health a year ago, resigning owing to a cabal of tenement property owners, on whose toes I had rather severely trodden."

9. "Those interested in property have it all their own way here, as no fewer than 14, all influential, are in the property business, and several other members rely on them for business."

10. "There is no doubt that the greatest opposition to sani-

tary progress comes from members of committees who are agents for or owners of defective cottage property."

11. "Two-thirds of the committee here are largely interested in cottage property, more or less defective, as agents or owners, and sometimes entirely depend upon it for their income from such property. One cannot wonder at the opposition and at the slowness of progress."

12. "The owners of property are well represented, and it is consequently difficult to get sanitary improvements carried out."

13. "Four out of nine members are owners of cottage property."

14. "Four out of six members are owners of property."

To recapitulate, the numbers of the different trades and professions are as follows:—

		Percentage			Percentage
Shop-keepers	862	30·84	Clergy	23	·82
Manufacturers	489	17·49	Schoolmasters	20	·72
Gentlemen	327	11·70	Artizans	17	·61
Merchants	241	8·62	Literary	8	
Farmers	216	7·73	Insurance Agents	7	
Builders	212	7·58	Army	5	
Lawyers	104	3·71	Artists	4	1·18
Doctors	89	3·19	Contractors	3	
Estate	56	2·00	Registrars	2	
Auctioneers	42	1·50	Undertakers	4	
Engineers	33	1·18			
Architects	32	1·15	Total	2796	100·00

It is thought the conclusion to be drawn from this investigation is that deducting the members of the unobjectionable classes, numbering 452, or 16·16 per cent. of the total members, and consisting of merchants, doctors, engineers, clergy, schoolmasters, artizans, literary, insurance agents, army, artists, contractors, registrars, there remain 2344, or 83¾ per cent. of the number of those serving upon Boards of Health, who, *taken as members of classes*, and considering their interests and fitness, either present a negative attitude or active opposition to the administration of the Public Health Acts.

It will be remembered that 75 per cent. of the circulars sent out obtained no replies, but it is not thought that the absence of these replies indicates a better state of things at the places of which no returns were made than appears to exist at the 25 per cent. of Health Boards, the returns from which form the basis of this paper.

It is not suggested that virtue dwells in one class more than in any other. Selfishness, the great human imperfection, pervades all classes alike, and power which gives facilities for the

exercise of it, becomes one of the greatest tests of human character. In the existing government of the world jobbery is as rife when the power of an aristocracy is supreme as it is where the most advanced democracies hold sway. There is no doubt that all classes of men are apt more or less to use the power given them to further their self-interests; and it is thought there is sufficient evidence in this paper to show that the influence they possess is thus exercised by a large percentage of those who administer the Public Health Acts, to the serious injury of the usefulness of these beneficent laws, and that some steps should be taken to remove the evils indicated, and secure to the nation a much more rapid advance in its sanitary condition.

[*This discussion applies to the two preceding papers by* Alderman J. S. Rowntree *and* T. Harnett Harrisson.]

Mr. H. H. Collins (District Surveyor of the City of London) expressed great regret that a paper, such as had been read, should have been published under the auspices of the Sanitary Institute. He questioned whether Mr. Harrisson had ever taken part in municipal government. No doubt that there were men, as in every public assembly, who occupied a position on local boards from not unselfish motives, but it was gratifying to find that members of every class were introduced to those bodies, who took an intelligent view of sanitary and other work. The "speculative builder" generally came in for a good deal of undeserved censure; but they should complain not of the speculative builder, but of the administrators of the law, who did not see that the laws regarding speculative building were efficiently carried out.

Mr. Washington Lyon (London) said the paper read by Mr. Rowntree was quite refreshing. It told them what the public ought to do, and it rested with the public to carry out what the paper suggested. All that was wrong within the Board was the fault of the people outside, who were the electors. He thought the other paper read by Mr. T. H. Harrisson, was a perfect burlesque upon local self-government, which, the speaker thought, was on the whole a credit to the country.

Mr. S. W. North (York), who said that hitherto he had never had anything to say at meetings of the Institute but what was agreeable and pleasant, strongly condemned Mr. Harrisson's paper as a libel upon the representative government and municipal authorities of this country. One point of satisfaction was that nearly 600 of the

medical officers declined to answer the impertinent questions that were put to them with respect to those in whose service they were. The Council, he said, should never have printed the paper, and he hoped they would redeem their position by expurgating it from the records to be hereafter published.

The Lord Mayor of York, after speaking in complimentary terms of Mr. Rowntree's paper, expressed his opinion that if the paper read by Mr. Harrisson appeared in the records of the Congress, it would do such an injury to the object of the Institute, as it would take years to repair. He was sorry to hear such a diatribe against the Corporations of this country.

Mr. Rogers Field (London) did not agree with the form in which Mr. Harrisson had put his paper, but could by no means give such scathing condemnation to it as had some members of the Congress. From his experience in London, he could strongly confirm Mr. Harrisson's statement that builders were often great enemies to sanitary progress, as they were the most determined opponents of anything they considered contrary to their interests. An instance of this was the way in which the builders on the London vestries opposed one of the greatest sanitary advances that had been made in modern times, viz., the enforcement of stringent regulations as to the details of the drainage and sanitary construction of houses. Such regulations, he said, were enforced in most large provincial towns, but they were exceedingly rare in London ; and it was to a great extent the builders on the vestries who prevented such regulations being made and enforced.

Dr. Ewart (Brighton) supported the views of Alderman Rowntree as to the proper selection and the payment of corporation officers. As to the second paper he thought it should only be published with a certain amount of revision. The speaker defended the members and permanent officials of municipal bodies from the charges made by Mr. Harrisson, specially emphasising the high character and excellence of the officers of the Brighton Corporation, with which he had the honour of being associated.

Mr. Whitaker (Southampton), as one who had not been a member of the local board, nor was likely to be one, bore his testimony to the good work done by many local boards.

Mr. M. Ogle Tarbotton (Nottingham) agreed with the views of Mr. Rowntree, but strongly opposed the views of Mr. Harrisson, and stated that any speculative builder who endeavoured to scamp his work would be sure to be found out.

Major Flower (London) said he protested against the views expressed by Mr. Harrisson in what the speaker called an "unfortunate paper."

Mr. G. J. Symons, F.R.S. (London), considered it unfortunate that the two papers had been taken together, because the somewhat vigorous language employed by the author of the second paper had diverted a good deal of attention from the large amount of information conveyed in Alderman Rowntree's paper—a paper of the very highest quality, and one on which there could not be two opinions. As to Mr. Harrisson's paper, there was a great deal of truth in it; and with respect to the remarks which had been made about the Council receiving and printing it, he would remind the Congress that the Council were not to accept only such papers as they thoroughly approved of and agreed with—that would not be the English principle, which was for free and open discussion. It would be utterly childish to refuse all papers except those with which everyone would agree. The Council was not responsible for the opinions expressed in the papers, and it was so stated in every volume of the Transactions. As to Mr. Harrisson's statements, it was well known that the facts stated were in many cases true. Moreover, they were *not* Mr. Harrisson's statements but those of his correspondents. He would not traverse all the remarks which had been made, but would merely state that the present filthy condition of our rivers was not due to the absence of legislation, but to its not being put in force, and it was not put in force because the offenders were also frequently those whose duty it was to commence proceedings against themselves.

Mr. W. R. Maguire (Dublin) said that as he was not a Medical Officer of Health nor a Member of the Council of the Sanitary Institute, he begged leave to differ from the opinions expressed by the preceding speakers on Mr. Harrisson's paper. We have all heard from time to time the complaints made by Medical Officers of Health of the very grievances which this valuable paper perhaps somewhat bitterly places on record. As a business man it seemed to him that the soreness and angry feeling evoked by the paper was caused by the unpalatable truth of the statements, and he hoped that the Sanitary Institute would publish this paper in their proceedings. Great trouble was evidently incurred in collecting materials and putting them together; evidently no reward was sought for or expected by the writer except the public good, and he (Mr. Maguire) thought that the paper had been very shabbily received.

Mr. Hanson (London) stated that, as Mr. Harrisson had said, the "Jerry builders" influenced the local elections in London in their own interest.

Mr. Alderman Rowntree (York), in a brief reply, said he believed that if medical officers of health presented their views to their boards and the public again and again, quietly, and in an educational way, they would in most cases ultimately obtain what they desired.

Mr. Harrisson (Liverpool) replied, and said his paper was suggested by papers formerly read at that Congress. His information had

been obtained from medical officers of health, and he believed that his paper was correct in its statements and conclusions. The language of abuse, as it had been termed, was not his, but that of the medical officers.

The Chairman, Mr. BALDWIN LATHAM, said Mr. Rowntree's paper was extremely interesting, and was put before them in such an instructive manner that he (the Chairman) could not add anything to its value. It was curious how Mr. Rowntree had linked the old with the modern period, and it was to be remarked that if the people now lived as our ancestors lived, the death-rate would exceed the birth-rate. They were indebted to Mr. Rowntree for the trouble he had taken in the matter. As to Mr. Harrisson's paper, it was no reflection on the inhabitants of a town that their local governing board was formed of a majority of tradesmen. He must, however, say that there was a substratum of truth in that paper as to the overriding of medical officers of health's proposals, and he spoke from large experience of such bodies. He knew that three of the ablest medical officers who ever held office in this country, who had given up their own profession to follow that of medical officer, had been driven out of office by authorities because these officers had done their duty. In conclusion he proposed a vote of thanks to Mr. Alderman Rowntree and Mr. Harrisson. The vote was carried *nem. con.*

On "The Sanitation of our Dwellings," by J. VICKERS EDWARDS, County Surveyor (West Riding, Yorkshire).

THE subject of this paper is, I am afraid, of such vast dimensions and importance, that it will be impossible for me to deal with it except in a general sense; hence I do not propose to go into matters of construction or engineering details. You can obtain that from the number of good books which have from time to time been written dealing with this question, and by entering into detail I should only be troubling you with matter that you can read in your quiet leisure.

That Sanitary Science has made rapid strides no one, I think, will be so bold as to contradict; for instance, what was the difference between the condition of London prior to the Great Fire and that of the present day? There then existed a network of narrow, dark, and tortuous lanes, the houses mostly built of wood and lofty, and each storey hanging over the one below, so as almost to meet

at the top, with large signboards extending half-way across the streets, all no doubt very quaint and charming in outline, but very obstructive to light and air. The sewers were ill constructed and totally neglected, and the sewage was allowed to flow in any channel it could, and in any way, so that it was got rid of,—that was the one thing desired. With the Fire came the first effort to promulgate certain useful and necessary regulations. The streets were widened, provision was made for the better drainage of surface-water, cesspools were formed for the prevention of choking the sewers with sand or gravel from the roadways, and regulations made for the cleaning of the public thoroughfares. From this period we have gradually gone on improving, and from the decreased death-rates it will not be denied that Sanitary Science has done something to lengthen the lives and add a little of happiness and comfort to our fellow-creatures. But there still remains a vast amount of work to be done. Local prejudice and self-interest have to be broken down, and the people gradually educated as to what is best for their welfare. Parents must be taught, that unless they have healthy, clean, sanitary homes there is nothing but a series of domestic troubles in store for them.

Dr. Richardson admirably gives seven points as an outline of general domestic sanitation, and they are as follows:—

"The healthy house must present no facilities for holding dust, or the poisonous particles of disease; if it retains one it is likely to retain the other.

"It must possess every facility for the removal of its impurities as fast as they are produced.

"It must be free from damp.

"It must be filled with daylight from all points that can be charged with light from sun without glare.

"It must be charged with perfectly pure air in steady changing current.

"It must be maintained at an even temperature, and must be free from draught.

"It must be charged with a sufficient supply of pure and perfectly filtered water.

"A house possessing the advantages named under these heads cannot be far from a perfectly healthy house. It is a house in which disease will never be generated so long as it is kept up to its proper standard. It is a house in which disease, if it be introduced, will remain for the briefest possible period. It is a house which, after disease has left it, will admit of instant and complete purification."

And in order to obtain these happy results, how is the work to be started? This is a very difficult problem. All localities

are not the same, one person thinks this way and another person thinks another, and I have no doubt that many of our sanitary engineers and sanitarians will be quite prepared to tell you of the enormous difficulties they experience with local authorities in getting a plan of any well conceived scheme of drainage approved of. Some municipal surveyor or local surveyor will say I could not possibly recommend my corporation or local board to approve of your plans. Your pipes are far too small, we cannot allow you to cut off your drainage from our main by your so-called intercepting trap, and you must place Buchan or other approved traps at the base of your soil pipes and generally ventilate your town sewers through your drains. I am not at all exaggerating this state of affairs, for on more than one occasion has this condition of things been tried to be imposed on me.

No, it is not by the action of these local authorities that sanitary science will progress, and it is not by a forced scheme of legislature that we shall be successful. The masses must be educated to act for themselves, and sanitary officers appointed who can lay claim by qualification to such an important office, and men who will act fearlessly, impartially, and with but one object in view, the health of their fellow men.

True it may be said there are such men appointed by the local authorities whose duty it is to report upon and take steps to abate nuisances and other matter prejudicial to health, but to what extent is that carried out and how can a man work against influence, and, generally speaking, what is the education scientifically of these men? I know, in my own town, the sanitary officer was asked, Have you had many complaints as to the smoke emitted from manufacturers' chimneys? Oh, yes, a great many, was the answer. What steps then have you taken to draw the attention of the manufacturers to their breaking the law? I have laid the complaints before the Sanitary Committee, and their answer was, You must not take any notice of these complaints, we wish there were more large chimneys in the town. However, I was not content with their answers. Single-handed I attacked the largest manufacturer in the town, and obtained a conviction in the Local Court of Justice, and in face, too, of an interested Bench. I merely give you this example to show that private individuals should not have to bear the brunt of the fray themselves, but that sanitary authorities should be compelled to do their duties.

Take yet another example, the rivers of the county. Instead of being carriers of pure fresh water giving happiness and joy to all in our manufacturing and closely-inhabited districts, they are simply carriers of sewage and filth, and yet these local sanitary authorities are armed with sufficient power to prevent

or certainly to ameliorate this condition of things; but no, self-interest steps in and says we must be neutral and not hurt our manufacturing neighbours.

In support of my theory that sanitary officers should be qualified men, having gained a diploma and certificate from the Sanitary Institute, and that no local authority should employ such an officer unless he held such a diploma, I will give another example. Take our large watering places—Scarborough, Blackpool, Eastbourne, Brighton, &c.,—where the major part of the population at certain periods of the year is ever changing, many of the lodging houses have obtained certificates of a clean bill of health as to the sanitary requirements of their houses. Well, at Scarborough and other places I know from experience you will find nine-tenths of the houses fitted up with old abominable pan closets, insufficiently flushed, soil pipes inside the buildings, a few may be ventilated, but the major part not, and when the soil pipe is ventilated what does it consist of? a two-in. rain water pipe carried from the trap up to above the roof with open joints, and crowned at the outlet with some wonderful head gear in the shape of a ventilating cowl; all this work doing more harm than good, and yet these houses are all certified, and the British public think they are quite safe. So much for the value of these certificates.

I hope I shall not be wounding the feelings or susceptibilities of our leading architects when I say that the scientific knowledge of drainage and sanitary plumbing is not sufficiently paid attention to by them; often, indeed, lines of drainage are indicated on a plan and left to be worked out by the clerk of works and builder. For a few years all may be well, but, depend upon it, the day of reckoning must come. What happens? A system of patching and botching up is done, and this makes the state of things worse than the first. I am sorry to say, in my short experience, I have met with lamentable cases of this kind. What I say to our architects is this, if drainage, water supply, and sanitary science be beyond the sphere of your calling, do not hesitate at once to call in some experienced sanitary engineer, who will guide you safely through, or, take the middle course, and have your opinions approved of by some such man: if you needs must err, err in good society. Speaking for myself, having had recently to carry out drainage and sanitary work to the value of £40,000, I called in a well-known sanitary engineer to aid and assist me with his experience; and I have no hesitation in saying success will be achieved where it might have been doubtful, and then, what a comfort and ease to your mind is the fact that you have your opinion endorsed by a competent authority.

That the general public are somewhat prone to under-estimate the value of carrying out drainage in a perfect and systematic manner is, I am afraid, not to be denied. Some of my clients have repeatedly said, "Could we not dispense with this costly system of inspection chamber, with its glazed brick sides and glazed stoneware inverts, and your Stanford jointed pipes?" "Oh yes," my reply was; "you can do without these things if you like." The case stands thus: With a system of drainage of straight lines, and inspection chambers and man-holes, every part of the system is accessible for inspection and cleaning. If you simply bury your pipes, however truly laid, without such, in case of stoppage you have constantly to be breaking open the surface. And which is the cheaper and better in the long run? To have a perfect scheme open at any point for examination, or breaking up the surface and disruption? No, depend upon it, care and regularity, and a thoroughly practical scheme, will pay the best in the end. And before closing my remarks upon drainage, I would impress the fact very strongly—never allow a builder to do anything with your sanitary arrangements; if you require advice, go to some competent authority. The amount of money expended by people in employing incompetent persons is something enormous, and I regret to say it is almost a daily occurrence.

Houses are bought without even a thought about their sanitary arrangements, then when something is required to be done, a builder, or some so-called sanitary engineer, who examines the house for a small fee, and recommends here a trap, there a trap, and everywhere a trap, is called in. The result of all this is, some recognised engineer is called in, who is horrified at the state of things, and the pruning knife has to be most unsparingly used. I assure you this is no uncommon occurrence; and to what does all this lead? The masses, as I said before, must be educated; it behoves every intending tenant or purchaser to make the most searching examination he can of the house he proposes to buy or inhabit. He must insist upon stipulations in the agreements, and protect himself by taking competent advice as to the structural and sanitary condition of the house to be leased or bought. Here again comes the importance of proper and vigilant supervision on the part of the local authorities over the construction of houses, and this is particularly needed for those dwellings of the poor and uneducated classes.

It was only the other day I was called in to give some advice as to the house to be occupied by a client of mine. Well, I examined it thoroughly. In the course of such inspection I found the soil pipe a $3\frac{1}{2}$ in. rain water pipe brought down the

inside of the house, connected to a 6 in. earthenware bend. At the joint it was open, being flagged over at the basement level; where the flag had been cut round the pipe, there was a hole $\frac{3}{4}$ in. wide, the soil pipe was carried up to the trap of water-closet (a wash-out type), and then terminated. Below the trap of this closet the lavatory waste and bath wastes communicated. The 6 in. exterior main communicated direct with the main sewer in the street. I told my client he was living in a house which was ventilating the town sewers, and further said to him what should be done. "Ah! well," says he, "I will do something; other people have lived in the house without ill-effects, and you are really such an expensive man. Can you not recommend some middle course." "No; you must do the thing properly or not at all. Remember, you have my opinion in writing, if anything occurs do not blame me." The result was, someone was employed to do something. I declined to act further, and I have no doubt my friend thinks he is quite safe. This, I am sorry to say, is one of the many cases a sanitary engineer meets with, and it is often a difficult task how to act; but depend upon it, the man who unswervingly sticks to his post and has the courage of his own convictions will in the long run succeed.

It will be seen that the preceding remarks have dealt in a general sense with exterior matters, I wish now to say a few words upon interior fittings and appointments. These should be of the simplest and plainest character, easy of access, no corner or crevice where dirt can possibly accumulate, and everything exposed, so that the eye can take all in at a glance; never bury pipes in a wall or cut a chase for them, whether they be hot or cold water mains, supply pipes or gas pipes, everything should be visible. At two asylums of which I am the surveyor the water main and steam pipes were so placed in the walls, and they have proved such a continual source of annoyance, by reason of their being simply rat runs, that I am now taking all the pipes out, placing them on the face of the wall. It may be argued they will appear unsightly, but better be it so than have a continual annoyance and trouble from vermin; besides, too, how can you get to repair a leaking joint when so encased. As to the effect of gas from a leaking pipe no one can estimate the damage upon the human frame from the effects of poisoning by escape of coal gas. I believe it is more deadly than sewage gas; slower, but surer, and more efficacious in its work.

Before closing this paper I would like to say a few words as to the general use of materials internally in buildings.

I think the walls of all kitchens and sculleries should be lined

with ivory white, glazed brick, or tiles, up to a height of 6 feet from the floor line. This would prevent splashing or dirt, and would be easily cleaned. The floors, too, might be laid with concrete floors of broken marble and cement, worked up to a very fine surface : such a floor is very readily kept clean.

The floors of a building should be laid, where wood is used, with oak boards ; but if expense has to be thought of, then pitch pine boards, $3\frac{1}{2}$ in. wide, tongued and grooved, and secretly nailed, make an excellent hard floor, which lasts very well.

I have seen many floors laid with yellow deal, where washing is a constant practice, rapidly going to decay after a few years use.

Floors of either pitch pine or oak, are capable of being highly polished, and the carpet need not cover the whole surface ; this is most desirable, as it allows the carpet being taken up oftener than it would be done if it covered the whole surface and was secured to the floor.

All fire grates should be constructed so as to entirely consume their own products. There are many such grates to be obtained, and it is, indeed, difficult to say which is the most desirable. By experience I have found any grate with fire clay sides that retains a heated chamber under the grate effectually cutting off the cold air of the room, will effectually burn coal to complete ash. Mr. Pridgin Teale, of Leeds, has paid some considerable attention to this subject, and he claims for this heated chamber —1st, saving of fuel; 2nd, more uniform heat ; 3rd, the longer keeping in of the fire without watching ; 4th, diminished soot and fewer ashes to remove.

As to ventilation and the different methods of heating, time would not allow me to go into this question. Simply let me say, although perhaps seeming a difficult subject, a little care and trouble will soon unravel all its mysteries. Let your inlets of cold air be always under control, and your outlets for vitiated air sufficiently numerous and the extractor powerful enough to do its work. As to the number of pneumatic extractors daily placed before our notice, I would not be so rash as to pronounce judgment on any one, although many have been used by me, but speaking for myself I would rely more for extraction of foul air upon heat, or where it is possible use a fan.

In concluding this paper I would especially draw attention to the important part furniture generally bears upon the sanitary dwelling. Let your fittings and appointments be of the simplest kind. Avoid excess of curtains; if they must be used, let them hang down in straight, natural folds from a brass rod, and not be draped or looped up as to form lodgment spaces for dust. All fringes and valances should be avoided for the same reason,

as well as from the fact that they are utterly inartistic. In a dining room they naturally absorb and retain the smell of food, and tend to make the room stuffy and unhealthy, and for the same reason they should be avoided in sleeping rooms.

Furniture itself should be so constructed as not to be heavy and bulky, but easily removed; if it is not, the floor space underneath will become covered with dirt; if it is necessary to have heavy furniture, arrange it so that you can sweep and clean underneath it. Do not rush with eager haste to furnish your house; take time, and let each piece answer the purpose for which it was originally designed.

Avoid an excessive display of gasaliers. If you must need have them, let them be plain and simple, of bronzed brass, and not lacquered; gas tends to destroy everything in our rooms, and to render them hot and stuffy and unhealthy. Avoid all papers for walls which hold dirt and are absorbent, and by all means let them be non-arsenical. Our continental brethren, by legislation, years ago, prohibited the sale of such materials, but we are too sacred a race for such radical edicts. Lastly, clean out as often as possible every room and every cupboard in your house; give away anything that is fit to give away, which may no longer be required by yourselves, and burn or destroy all other litter and lumber, which only affords resting-places for dirt and dust and living impurities which grow out of dirt and dust.

[*For discussion on this paper see page* 246.]

On "The Ventilation of Factories and Workshops," by William Tattersall.

The efficient ventilation of Factories and Workshops is, it seems to me, a very important branch of practical sanitation, and as I cannot find that it has been dealt with previously, I venture to put before you some considerations and suggestions which are the results of my experience in this particular line of Sanitary work. As the chief trades carried on in factories are the textile trades, it may be interesting to know that, according to the census return for 1881, the number of persons engaged in those trades in England and Wales was over a million; of whom 530,000 were engaged in the cotton trade, and 233,000 in the woollen and worsted manufacture; the remainder being engaged in the manufacture of hosiery, silk, lace, linen, carpets, hemp,

&c. In the cotton manufacture, the proportions of the sexes employed was 164 females to every 100 males; in the woollen cloth manufacture there were 102 females to 100 males; and in the worsted and stuff manufacture 180 females to 100 males; in the silk and ribbon manufacture the proportion of females was still greater, as there were 224 to 100 males. As there is no doubt that a considerable proportion of factory operatives are young persons, the importance of efficient ventilation is further emphasised, and is generally admitted by everyone, in theory. But judging by the state of many factories and workshops, its importance is very slight, in practice; and the following extract from the last report of the Chief Inspector of Factories and Workshops is interesting in this connection. He says:— "The injury inflicted by an unfenced piece of mechanism cannot be hidden, and enquiry as to its cause leads to a recommendation which would prevent accidents in future. But the evils which follow constant employment in overcrowded and ill-ventilated workrooms, are insidious in their inception, rarely complained of openly by the sufferers, and do not in their effects appeal so readily to the sympathy of employers, as do the injuries to the person caused by machinery. It becomes thus a more difficult matter for us to deal with overcrowding and want of ventilation."

The particularly unhealthy conditions under which the textile trades are carried on, are commented upon as follows, in the supplement to the last annual report of the Registrar-General. He says:—"Among the textile industries there are two in which the death-rates are high, and unfortunately these are the two in which by far the largest number of persons are engaged, viz:— the cotton industry of Lancashire, and the woollen and worsted industries of the West Riding. The comparative mortality figures in these industries are 1088 and 1032* respectively. It can scarcely be doubted that the main cause of the differences is to be found in the conditions under which the industries are severally carried on, and especially in the differences that they present in regard to the dustiness and the temperature of their respective working-places. In the cotton factories the temperature of the weaving sheds is described in a recent (October 1883) report by Dr. Bridges to the Home Secretary, as "tropical and relaxing;" and dust, composed partly of filamentous particles of cotton and partly of mineral substances used for sizing, is stated to be a notable feature in most of the sheds." It will be found also on examining the tables, that the death rates from diseases of the respiratory organs are very high in the Lancashire and West Riding towns, where the textile trades

* See Supplement to the 45th Annual Report of the Registrar-General, page 24.

are mainly carried on; as the following extract from the supplement previously mentioned also indicates; writing of the effect of dust on the respiratory organs, the Registrar-General remarks:—"More injurious than either coal-dust, wood-dust, or the dust of flour, appear to be the filaments and fluff and other dusts that are given off in textile factories; the mortality both from phthisis and from diseases of the respiratory organs being higher among workers in cotton and in wool than among persons exposed to either of the previously mentioned kinds of dust. The workers in cotton factories fare worse than those in wool, the comparative mortality from the diseases in question being, 543 for the former and 462 for the latter. It must be remembered, however, that the air in the weaving sheds of cotton factories contains not only flocculent matter, but also a large amount of dust from mineral substances of various kinds used in sizing, and that the inhalation of mineral substances, judging from industries presently to be considered, is much more injurious than the inhalation of textile filaments. The deleterious effects of dust upon the air-passages is increased both in the cotton and in the wool factories, and especially in the former, by the high temperature in which the work is carried on, and it is impossible to say how much of the lung mortality is due to the latter cause, and how much to the dust.

So much then for the considerations as to the need of ventilation in Factories, and I take it that if they had been more efficiently ventilated than appears to have been the case when the foregoing observations were made, and which by my own observations is the case now in most factories, the presence of polluting matters would not have been so evident, as they would have been got rid of as fast as produced, and so the evils resulting from their presence would have been much less.

I pass on now to a consideration of the means by which these evils can be lessened by an efficient system of ventilation, and in doing so I propose to consider the main sources of impurities separately, and in each case the production, amount, effect and removal of such pollution. The main sources of impurity in factories I have found to be as follows: and I say nothing further of the impurity arising from, or given off by the workpeople themselves, as that is seldom or never the only or main source, and is merged into the greater, both in effect and removal. The principal impurities are *dust*, *fumes*, *excess of moisture*, and *heat*. Objection may be taken to *moisture* and *heat* being considered as impurities, but in excess their effects are probably as ill as those of the actual impurities, and therefore they need removal.

In many cases *several* of these impurities are present together,

aggravate the nuisance, and often make its removal more difficult. *Dust* I have found to be the greatest impurity, and to be present, more or less, in almost all the processes through which textile fabrics pass in manufacture, and often where the stuff is made into clothing.

The rooms where the carding, combing, winding, spinning, &c., of cotton, woollen, worsted and other textiles is carried on, all have their air rendered impure by the dust and particles of fibre given off from the material in course of manufacture, and in addition the sheds in which *cotton goods* are woven, and especially with certain classes of goods, the solid particles of the size with which the yarn has been treated becomes loose, and in addition to particles of cotton, float about in the air of the shed in considerable quantities; and to prevent this result, and because more work can be got off in a certain time with a moist atmosphere, an apparatus known as a Humidifier is used: by means of which, saturated air at a high temperature is forced into the shed, keeping the air inside *hot* and *moist*, and to prevent radiation of heat and condensation of the moisture, all apertures that *might* admit fresh cool air, are carefully stopped up, including both inlets and outlets for ordinary ventilation, if any have been provided, which in many cases they have not; some employers simply blow steam into the sheds during meal times, and trust to that for keeping the place moist enough for their purpose during the rest of the day. As artificial moisture is most needed during *frost*, the effect of passing from the warm moist air of the weaving shed to the cold frosty air outside, must be very injurious, as may be imagined.

A report on this subject was, I believe, made some years ago by Factory Inspector Osborne, in which he came to the conclusion, that by using proper ingredients in the preparation of *the size*, there would be no need to introduce moisture into the sheds; and as the principal object of heavy sizing is, I presume, to give a fictitious weight and value to the cloth, not much sympathy would, I think, be extended to manufacturers if they were forced to discontinue such an unhealthy system.

In the weaving sheds of other textile trades, as *Woollen*, *Silk*, *Worsted*, and *Flax*, the impurities consist of dust and fine loose particles of whatever material may be worked there; with, in Winter, during a considerable part of the day, the impurities from a great number of gas lights, and in Summer great heat from the sun shining upon the glass roofs, and in some cases always, and especially in hot weather, the foul smell from closets and urinals adjoining the sheds, and not properly ventilated or constructed, or not regularly emptied.

Carding Rooms, at particular times, when what is called

grinding the cards is taking place, and the preparing rooms for silk, are extremely dusty. The breaking-up rooms also for other materials, such as Waste, Shoddy, and Rags for Paper Makers, and Esparto grass cleaning, and the rooms where these materials and Wool are sorted into different grades or qualities, are often so full of dust that the workpeople, who are mostly women and girls, have to wear a bandage over the mouth and nostrils to enable them to work at all. In many of the workrooms enumerated above, there is great excess of heat, and in some very foul smell arising from the material; the worst in this respect being probably silk-waste preparing rooms, in some of which the stench is frightful to a stranger, though it is said that the workpeople become used to and do not perceive it after a while. In many workrooms also, other than textile, there is a large amount of floating dust to contend with, as in all dry grinding processes where metal is ground on revolving discs, examples of which are: the glazing of metal faces in machine shops on emery discs, and the pointing of pins for textile machinery, in which processes large quantities of minute particles of metal and stone are set free and float about in the air.

Excessive Heat.—There are many workrooms in which this is experienced. The machine rooms in calico printing works, some of which in summer get as high as 130° F. The machine rooms also in paper mills, and the rooms in which *fine yarns*, both cotton, woollen, and silk, are gassed, or run through flames produced from a mixture of coal-gas and air, to finish them smooth. These rooms are the foullest that in a considerable experience I have come across, and this is not to be wondered at when we know that some thousands of gas jets are burning, and the whole of the fine particles that have been singed off the thread are floating about in the room, and produce an intolerable, irritating effect on the throat, nose, and eyes of strangers; and I have often seen the women and girls forced to go outside, and stay out a considerable time, to recover from the effects of working in such an atmosphere. The finishing, singeing, dyeing, and pressing rooms for textiles have usually a very high temperature. The rooms in which wool is washed, and cotton and woollen yarns are sized and dried, and the drying rooms for wool, yarn, cloth, &c., are among the worst, and especially as the excessive heat is accompanied with excess of moisture. I have known many rooms of this kind to have temperatures from 150° to 200°, with the air so full of moisture that a fall of 20° would produce saturation.

The combing and spinning rooms are kept above normal temperature and artificially moistened, but it is said this is necessary to produce good work.

In other than textile factories, the ironing rooms of steam laundries, and the making up and pressing rooms of wholesale clothing factories, in which much gas is burnt to heat the irons, are examples of workrooms in which the temperature is excessive, and the air foul.

Steam or excess of moisture, as an impurity, has already been mentioned several times, besides which instances it is found in excess mostly in dyehouses, where it is often produced in such immense volumes, and so continuously as to be quite beyond the power of any appliance to remove at a reasonable expense. In cold and foggy weather the moisture becomes most visible, as the point of saturation is sooner reached, and dyehouses become filled with thick fog for days together, so that nothing can be distinguished at a few feet distant. As dyehouses are generally of open and lofty construction, and there is no excessive heat, the health of the workmen does not appear to suffer much from their constant work among steam, and one hale old fellow of 75 to whom I spoke seemed to think it beneficial.

The construction of factories or rooms will govern the application of any system of ventilation to them. The ordinary method of ventilating weaving and other sheds has, I think, usually been inefficient by reason of the contrivances for exhausting the foul air being inadequate at their best, and uncertain in action when most needed, and also because the inlets for fresh air were not under control as to the quantity, temperature, or direction of the air admitted.

The exhaust has usually been by means of automatic ventilators of various kinds plentifully sprinkled about in the roof, and without in many cases any particular provision for inlets, or with simply holes in the walls which allowed the air to enter in gusts, and ensured the holes being speedily closed or stopped up with rags or anything else convenient. The lobster back cowl, and other wind-driven ventilators, are liable to get stuck and act as inlets, besides which in hot weather, when most needed, there would very likely be no wind to cause them to act. This last remark applies also to induced current ventilators, besides which none of those mentioned produce, at the best of times, sufficient movement of air to carry away the particles of floating dust, so that for this purpose an appliance is needed which will move air in large volume constantly, and be under control, as to the quantity moved; this is found in a type of exhaust fan, dealing with large volumes of air at low pressure, and requiring small power to drive, and which, placed near the centre of a shed, will exhaust air in proportion to the speed at which it is driven, and may be regulated to suit the temperature and other requirements, or amount of impurities

existing. We thus get a current of fresh air traversing the shed from all sides to the centre, and there being *constantly* discharged, irrespective of wind or weather. In some large sheds, several may be necessary, and in one very large one, I put four fans, having an aggregate displacement of 120,000 cubic feet of air per minute, or 7,200,000 cubic feet per hour, which changed the contents about 8 times per hour.

The best results have been achieved by placing one or more exhaust ventilators near centre of shed roof, and arranging the inlets at regular distances around the walls. The amount of air to be passed through will depend on the temperature and rate of pollution inside, and the inlets may, if needed, be carried down from roof, and the entering air warmed, cooled, or moistened at pleasure; there are plenty of appliances to be had by which air can be admitted without draught. A series of rooms, one above the other, may, if not too large, be dealt with by one exhaust ventilator, placed at the top of a vertical shaft, extending through the several stories and with outlets from each room, the inlets for fresh air to each room being so arranged that the air may, in its course from inlet to outlet, traverse the room, and especially that part in which the greatest source of pollution exists.

It is obvious that a series of small rooms on the same floor level may be dealt with in a similar way, by a horizontal air duct with openings to each room, and inlets as suggested above. In storied buildings in which the rooms are too large to be dealt with in this manner, each room may be treated separately, and many large workrooms are so treated, by having one or more exhaust fans placed on one side of the room, and fixed either to discharge through windows or openings specially made. The inlets in this case would be arranged on the opposite side of room to the fan, and possibly at the ends, if required, so as to cause the current of air to traverse the sources of pollution, whether dust, heat, fumes, or steam. Generally, the requisite effect in removal of polluting matters is obtained by running the fans entirely free from any kind of tubes on feed or room side; and where possible this is best, as less power is needed to drive them, and more air is moved when the area of feed is unrestricted. There are, however, some cases in which it is necessary, and many in which it is advisable, to carry away polluting matters immediately they are set free, so as to prevent their distribution in the atmosphere. In these cases it becomes necessary to construct tubes with openings near the source of pollution, and connected at the other or exit end with a fan, which when working produces a powerful exhaust, and carries away the polluting matter as fast as it is

produced. This arrangement may be, and is, applied with perfect success to remove dust, heat, steam, and fumes of various kinds. The tubes may be carried overhead, underneath, or level with the sources of pollution, and the impurities carried away may be dealt with in a chamber, so as to retain them and allow the air to escape pure. A good type of this arrangement has been largely carried out for the prevention of what is called "Woolsorters' disease." The men who sort the wool work at continuous tables, which usually are fixed along the sides of large rooms, close to the walls, and at which each sorter works opposite a window, on account of the light. In sorting the wool the sorter takes a portion from a heap placed on the table near him, and shakes it to loosen and open it out, so that he may judge of the quality, colour, &c.; and it is at this point that the greatest danger of infection occurs, as the shaking sets free the dust, short fibres, and other light matters, amongst which may be the bacillus, or germ of infection. To prevent, or at any rate lessen, the risk of infection, there is made opposite each sorter an opening in the table, to which is fixed a short downcast tube, which is connected with a larger horizontal tube beneath the table, at the extremity of which is working a fan, producing a powerful exhaust current in the system of tubes, and carrying away the dust set free by the sorters shaking the wool, which they do over the open ends of the small tubes.

In opening the bales of wool, also, a similar arrangement is used, but on a much larger scale, as the quantity to be dealt with is very much greater. In both cases there are wire gratings above the tables to keep the wool out of the tubes and allow the solid, but not floating matters to fall on the table for collection. This dust is most successfully dealt with by being blown into a settling chamber, in which a series of steam jets meet and damp it, so that it is deposited, and can be collected and burnt periodically.

I may mention, amongst other applications of this system, the removal of dust from silk dressing machinery, in which the main air ducts are carried overhead, with small vertical dependent tubes, terminating in hoods which cover the area of dust-production, confining it and facilitating its removal.

The fine dust produced by dry grinding processes, in which metal is ground against rapidly revolving discs of emery or stone, is also removed by a similar arrangement, in which the main tubes are about level with the grindstones and have openings opposite each stone, in such positions as to catch the dust as it is driven off and carry it away at once.

It will occur to anyone acquainted with work in factories that this system of extraction along tubes may be applied with

great advantage in many cases not specified in this paper. This is so; but to avoid error I have mentioned only such as I have designed and seen carried out, and are now in operation; and not all of these by any means.

In the construction of the air ducts the following points need attention, and the suggestions I offer are the results of, and have been verified by, experience.

The best material for tubes is galvanized sheet iron of a gauge proportionate to the diameter of the tube; it is light and strong, and is easily made into tubes of a circular section, which are smooth inside, and reduce friction to a minimum.

Wood is the other material available for tubes, and the objections to its use are, that it cannot be formed into a circular section, is liable to warp, twist, and crack, and causes greater friction of the air, and consequent loss of power. Its advantage is that it is cheaper (about one-third) than galvanized iron for tubes of same area.

In forming ducts inside walls or underground the best materials are: for large air ducts glazed bricks set in cement, or for smaller ducts glazed and socketted earthenware pipes jointed in cement. Bends, and especially right angled ones, should be avoided as much as possible, and where unavoidable should be curved to a large radius, or the tubes enlarged to reduce friction; inspection holes should be provided near bends. Branch tubes should be connected to main tubes by being curved in the direction in which the current of air is travelling, and I have got the best results by bringing small tubes, such as those connected to the woolsorters' tables, into the main tube at an angle of about 45° and enlarging them at the junction.

The openings near the fan should not be made too large, so that those further away may get their due proportion of draught; if this is not done, the fan draws its supply of air from the nearest openings, and the further ones are of no use.

No particular rules can be laid down to work to in proportioning the sizes of openings according to their distance from the fan, as much depends on the sizes, material, section, number of bends, and length of main tube, but a safe plan is to have each opening provided with a slide, so that they can be adjusted to give equal draughts, and then fixed to prevent tampering with by workpeople, who very often imagine, if they see an open tube, that they feel a draught, and would rather in many cases stand the chance of infection than have the temperature of the room lowered by a good system of ventilation, without heating. In one case I know, the woolsorters employed by a large firm petitioned that the system of ventilation described above might not be applied to their tables until the rooms had been heated

by steam pipes, which it took several months to do, and during which time they were working in a constant atmosphere of fine dust. In many other cases I have known workpeople stuff up every opening, and even paste paper over every crack or crevice that might admit fresh air. This sensitiveness is no doubt largely due to the quiet, still nature of their work, which requires very little moving about or exercise, and causes them to feel the smallest movement of the air. At the same time there are many workpeople who are very careless of the way in which they expose themselves or others to insanitary conditions, and will take their food without washing their hands, or removing their working smocks, and even take their meals seated on the work benches or tables, and amongst the unhealthy matters they may have been manipulating, and this in spite of the fact that special facilities have been afforded them in the shape of washing and dining rooms. Though many of the operatives are no doubt very careless and ignorant as regards sanitation, still there are some who appreciate its benefits, and credit is due to those amongst the woolsorters who agitated for compulsory bye-laws, to compel the best known means to be taken for the prevention of the mysterious and fatal disease to which they are subject, which agitation resulted in a series of regulations being drawn up, and agreed to by the Local Authority, Employers, and Operatives, which, though not compulsory, are generally carried out, and must contribute very greatly to the general health and comfort of the workpeople.

Employers are not always willing to take the necessary steps and spend the money necessary to ensure even moderately healthy conditions in their workrooms, where there is not a direct and perceptible result in better work turned out, or more of it. This disinclination is to be traced in many cases to the fact that they have already spent considerable money in that direction without getting adequate results, and so become doubtful of any good result following further expenditure, though no doubt the feeling of some employers on the matter is similar to that of one who asked the cost of ventilating a room, in which the operatives complained of being nearly roasted, and on being told the cost, which was evidently much larger than he imagined it would be, he simply remarked, "Let 'em roast, then."

In conclusion, looking at the important bearing that the efficient ventilation of factories and workshops, not only in the cases mentioned but also in very many others, has upon the public health, it seems to me that there should be some authority with power to compel the best known (or at any rate a satisfactory) means of ventilation to be carried out in what may

be termed unhealthy trades; what that authority should be, or the circumstances under which it should act, I do not pretend to suggest; but think that the Council of the Sanitary Institute might profitably consider the matter, and prepare a recommendation on the subject.

The exhaust ventilator mentioned in this paper is that known as the Blackman Air Propeller.

[*For discussion on this paper see page* 246.]

On "American Sanitation," by John B. Gass, A.R.I.B.A., Graduate, Godwin Bursar and Medallist of the Royal Institute of British Architects, &c.

In the following paper I propose to give a general account of the leading methods of Sanitation adopted by American architects and engineers, noted by myself during a professional visit to America last year. Having had the honour of being elected by the Council of the Royal Institute of British Architects to the Godwin Bursary and Medal for 1885, I travelled with official letters and introductions to examine into and report upon American methods of building, construction, arrangements, sanitation, &c. My report on the latter subject, though probably not presenting anything new to specialists, may, I trust, be of some little general interest.

It is only of late years that much attention has been given in America to the sanitary arrangements of towns and buildings, and the better understanding of what precautionary measures are necessary for the public health. Architects and engineers recognise the importance of sanitary matters, and manufacturers are stimulated to develope appliances to meet the latest sanitary requirements. The American public mind has been stirred in these matters, and the National Board of Health at Washington, and the Boards of Health of the various States, are doing excellent service. The reports of the Washington Board, which (I believe) are in the Library of the Sanitary Institute, and which I brought over for the Library of the Royal Institute of British Architects, contain information of much value, though unfortunately the last report is only of small dimensions, owing to the limited appropriation of money

granted by the Government. In many of the cities there are stringent sanitary regulations, which are very good, but, unfortunately, they are not always carried out, as the curse of the speculating and jerry builder hangs over America as well as England. Building Inspectors are not always able to insist on a full carrying out of their regulations, and perhaps even Building Inspectors have occasionally the "itching palm" with which the American public service is so much credited. In one city, where the plumbing regulations are very strict, I was told that the purchasers of a row of good houses, on entering into possession, found that all the elaborate plumbing fixtures were without any service or waste piping at all.

As the ordinary system of city drainage takes rain and storm water in addition to foul water, pipes and culverts of large diameters are used. In hot and dry weather, which often lasts for considerable time, when there is the greatest decomposition of sewage matter, there is no storm water to flush, and there is also a decomposition of filth in the street water catch basins. There is also the difficulty of ventilation, and the storm water makes an embarrassment in the treatment of the foul sewage. In some parts of Philadelphia the slop water from the houses discharges into surface gutters in the streets. These are very objectionable, particularly in hot weather, when the smell is very offensive, or in frosty weather, when the foul water freezes. Many of the American cities are badly drained, and the disposition of the sewage is often a matter of great difficulty owing to the sites of these cities being frequently flat. There are various ingenious systems for its treatment and disposition, but in practically the majority of cases it is turned directly into the nearest river, lake, or sea, without any treatment whatever.

The connection of any good system of house drainage to the ordinary main sewer is trapped, with "breather" pipe on the house side. This, where possible, is at some little distance from the house, and anyhow away from window or door: it is carried about five feet above ground, of good diameter, and with end turned downwards. In cities where the main drainage is only at the front of house and the closets, bath, &c., at back, it is necessary to run the pipes through the basement. This inside drainage is very common. The iron soil pipe passing through cellar is carried, if practicable, in full sight along the face of cellar wall, or suspended from the floor beams. If it is carried under floor it is encased in strong cement concrete with sealed hand holes for cleaning. Where passing through foundation wall, arched opening is left, and the iron pipe taken at least five feet outside, where it is connected with the earthenware drains. If the ground is not solid the iron pipe is carried

further and encased in concrete—this gives greater certainty of tightness and correct grading. When the trap disconnecting house drainage from main sewer is on the soil pipe, and inside cellar wall, it is of iron and fitted with cleaner, the breather pipe being carried outside to curb or fence wall, with gird at end.

The ordinary system of city drainage being very defective, it is interesting to note a departure from it in the sewerage of the city of Memphis. Here is the best known and largest example of the application of the result of the investigations in various cities, by order of the United States National Board of Health. In these cities, the main sewers were gauged to determine the actual size of pipes needed for the removal of the greatest amount of foul sewage matter only, produced under various circumstances. These gaugings (a full account of which was published in the Board's report for 1885, fo. 354) show conclusively that for foul sewage matter for a large population, main drains of only small diameter are necessary.

Colonel Waring, of Newport, R.I., the engineer who designed the Memphis sewage scheme, communicated a paper to the "Sanitary Institute," in September 1880, giving a full account of this work, which is no doubt familiar to the members. It has now been in use over five years, and the practical working appears to have been very satisfactory. To recall the main features, I may state that Memphis is a city on the Mississippi, of between forty and fifty thousand inhabitants. The main drainage system is for foul sewage only, and when complete will have a total length of about forty miles. There being very few cellars and the ground having a good natural fall, the drains were laid about 6 ft. deep. No outlet drain from any house was allowed more than 4 in. diameter, the tributary mains being 8 in. and 6 in. diameter, and the two mains commencing from 8 in. diameter, and increasing to 12 in. and 15 in. diameter, all being of socketted glazed pipes. The two mains are joined together into a 20 in. brick sewer, which has switches turning the drainage into a 3 ft. iron pipe for the high water outlet, and into a 20 in. iron pipe for the low water outlet, the extreme variation of level in the river being 35 feet. On the main lines, man-holes have been put in at intervals. No house connection is trapped, but each has an unobstructed ventilator reaching to top of roof; this gives vent to about every 30 feet of sewer. Every slopstone, water-closet, sink &c., has independent trap; hopper closets are insisted on, the sanitary regulations are very strict, and all plumbing work is inspected by engineers. The whole system is flushed daily or half daily with about 150 Rogers

Field's well known automatic flush tanks, supplied with town water, and placed at the dead end of every branch to thoroughly flush each length; each flush tank discharging about 100 gallons in 40 seconds thoroughly scours the pipes. The subsoil drainage is by agricultural drain tiles, 1 in. to 3 in. diameter, laid beside sewer and in the same trench; these discharge into the nearest water course, or on very level ground into the main sewer, with special precautions against sewer water backing up. Storm water is removed by surface gutters with outlets through shallow conduits easily accessible.

On this system there have been official reports by Mr. Gardener, for the Board of Health, New York State, and Mr. W. H. Baldwin, C.E., the latter dated March 29th, 1884. The following is a summary of these reports with regard to the working: "In the mains, from 10 in. and over, a deposit is found of fine silt, supposed to be mud and paper pulp; this is cleaned out about once a month by rope and steel brush being dragged through from man-hole to man-hole. In the lateral sewers there are very few stoppages; where stoppages occur they are from schools or shops only, and in pipes 6 in. diameter and under, and are caused by sticks or pieces of metal getting crosswise in the pipes. For stable washings catch pits have been found necessary. A few T cleaning pipes have been inserted, and hand-holes are now put in all extensions about 100 ft. apart. Some of the sewers are 2,000 ft. from the mains, and the longest lines generally run about quarter full. Overflows have had to be provided for taking the water in winter, when the water taps are left running in the houses to prevent them freezing. Neither in removing obstructions, in cleansing the main sewers, nor in connecting with house drains is the odour of sewer gas ever observed."

This system was adopted at Keene, N.H., and executed in 1882-3. I am informed that it is working well, though the greatest fall is only 4 in. in 100 ft., the lowest fall being $\frac{1}{10}$th in. in 100 ft., and that line nearly two miles long. It is also being used in parts of Paris and other places, and may, I think, on a large scale, be considered a success.

In the country districts, where there is no regular system of sewerage or convenient water course, house wastes are disposed of by means of cesspools, the commonest form of which is the "Leaching cesspool," which is only of use in sandy or gravelly soils, and should not be used where there is a chance of contaminating water supply. It is built circular, 8 to 12 ft. diameter, of depth requisite to reach an absorbent stratum, the sides lined with dry wall of stone or brick, and the top drawn over dome-shaped with man-hole at top—covered with loose flat

stone, and earth over. Subsoil irrigation is being much used, the sewage being conveyed to tight cesspool or tank, having outlets to irrigation field or surface by a series of open-jointed tiles. Rogers Field's automatic flush tank is used most successfully, as also are ordinary tight cesspools placed at a higher level and let off at intervals. The tight cesspool with overflow at top is also in use, but, as the sewage water is not delivered intermittently or in large quantity, it is not successful.

To prevent damp in cellars or foundations, under-draining is resorted to, and formed with agricultural drain tiles of small diameter, well graded, and laid, with "muslin" joint or paper cap, below level of foundation. This is kept separate from other drains, and discharges into water-course if practicable, or, if connected with main drainage, is carried some distance from house, and tiles stopped at least 10 ft. from connection, this length being filled in with very fine sand or gravel. When a gravel under-drain is used it is excavated for as tile drain, and bottom filled in to about 12 in. deep with sand or fine gravel.

To prevent ground smells rising in house 6 in. clay puddle or thick coat of asphalte is put under floors and rammed in at side of wall.

Plumbing.—Lead is mainly used for plumbing in England, but in America iron takes its place, being used for soil pipes, supply pipes, and wastes, except in cases where there are many bends, or in branches of small diameter.

The soil pipes are generally of cast iron of extra thick metal with turned socket joints, made with oakum driven in tight and finished with melted lead, which is tightly caulked after being run in place. Joints are also made with sal-ammoniac and iron filings; turned socketted cone joints are used and flange joints, bolted together, with lead washer, star-shaped in section, which flattens out when bolted up and forms a good joint. Wrought iron soil pipes, in long lengths with bolted flange joints, are also used. The soil pipes are usually coated with asphaltum, inside and out; some are enamelled inside or dipped in patent solution, of which there are many sorts.

Owing to the severity of the weather in winter it is often necessary to keep the soil pipe inside the house or inside "plumbing tower," heated in winter: it is used as the waste for all the plumbing fixtures, the pipes being prepared with the necessary Y branches for connections. Where lead pipe is connected with the iron a tinned brass joint-piece is inserted, caulked to iron pipe, and the lead pipe connected to it by a wiped solder joint. Under ordinary circumstances 4 in. soil pipes are generally found sufficient; in 3 in. pipes there is better flushing, but greater danger of syphonage upon lateral

branches; this danger decreases by the use of larger pipes, being in inverse proportion to the diameter of pipe.

The soil pipe runs up to the roof of full diameter, then for a length at least on the outside of greater diameter, using an increaser joint of 4 in. to 6 in., which is said to give effective increase to the movement of air. At the top a spherical wire basket is placed to prevent obstruction. Ventilating cowls or covers of any sort are objected to by many as obstructing the current and increasing the friction, particularly so during calms or light winds.

The soil pipes are carefully tested under hydraulic pressure, or by air pump and pressure gauge as used by gas-fitters; the plumbing fixtures are afterwards tested by the usual peppermint or smoke tests.

Extreme simplicity of plumbing arrangements is advocated, and in some very large houses I visited, carefully carried out. The water-closet is arranged to do duty as urinal, slop-sink, &c., and water drawn by housemaid from bath taps or stand pipes. All wastes and traps are exposed to view with absolutely tight blocking for every pipe hole, and no wood casings to closets, wash-stands, or bath. For water-closets the seat is formed of hard wood, on cleats at sides, and hinged to be turned back. Most of the water-closets are imported from England—the Brighton, Jennings', Hellyer's, and others being in use. The distinctively American ones are cleared by syphonic action; the "Dececo" is on the principle of Field's Flush Tank, and seems to answer very well, but the trap cannot be ventilated, as it would interfere with the formation of vacuum before the syphon will act. There are others on the same general lines of varying values, some of which are arranged with air pipes to traps, which are kept closed by valve, except in case of under-pressure.

Urinals are rarely found except in hotels and public buildings.

The bath tubs are ordinarily of tinned and planished copper, 16, 18, and 20 oz. metal; they are also used of iron, enamelled or painted, while the earthenware ones are imported from England. In the overflow to bath tubs, as ordinarily arranged in English baths, the dirty water rises to same height in it as in the bath when let off; it therefore gets fouled, and not getting flushed is a frequent cause of bad smells. In many baths in America there is no overflow at end, but copper or brass stand pipe, the height for water, fits into outlets and serves as plug.

Wash-basins are in single pieces of earthenware, with several patent overflows and wastes; the stand pipe overflow is in use for these, the basins being drained from the back, with the

stand pipe in recess, and raised or lowered for outlet by small lever at top of basin. Kitchen sinks are the same as in England, and made of metal or porcelain, with outlets as used in wash-basins.

Each of the plumbing fixtures is separately trapped, there being many traps of varying value. The common S or V trap, with ventilation connection attached, is ordinarily used. Putnam's Sanitas trap is said to be made so that it cannot be syphoned; it consists of an adaptation of the S trap, with the water passage diverted by a bent plate, causing it to flow round a strong glass bowl let into side. It has no moving parts, is easily cleaned, the interior being exposed to view and holding a large quantity of water; the water seal cannot be readily broken. There are several traps having movable parts, usually with ball valve, but these are always liable to get out of order.

To kitchen sinks numerous forms of grease traps are used: the ordinary one is outside in yard, forming a settling pit and with cleaner on top. The "Dececo" flush pot is fixed underneath sink; it is made of glazed earthenware, inverted pear shape, and holds about six gallons. In the sink is the ordinary grid with waste, which discharges into the flush pot, at the bottom of which is also outlet with plug worked by lever from top of sink. When the pot gets filled the outlet from it is opened, the rush of water carrying everything with it and flushing the drain.

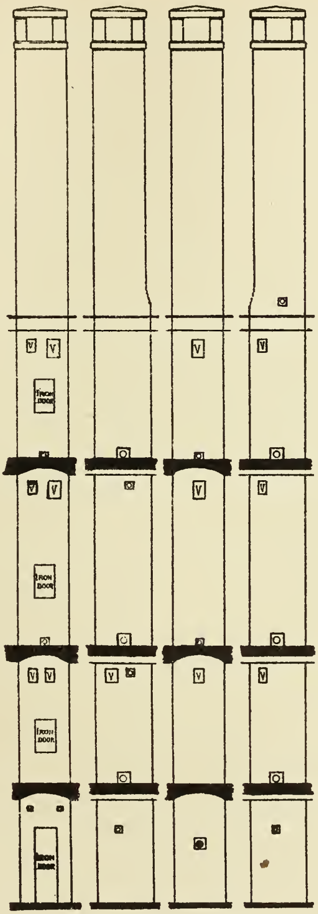
All the municipal plumbing regulations require that traps shall have back ventilation with air pipe not less than $1\frac{1}{4}$ in. diameter for small traps, or 2 in. diameter for large traps. The question of the back ventilation of traps is a point of contention with many of the leading sanitary engineers in America. The results of experiments by various engineers are published in the National Board of Health's Report for 1882 (folios 135 to 152), but unfortunately there is a complete divergence of opinion. If traps are *not* ventilated there is a danger from syphonic action and traps emptying for want of air. When traps *are* ventilated the danger is from destruction of water seal by evaporation, or from aid to trap emptying by capillary attraction when any hair or material gets over the edge of trap. Further experiments are, I believe, being conducted on this vexed question.

At the Mass. Geiz. Hospital, Boston, a Sanitary Tower and ventilating shaft has been recently built for the wastes from hospital plumbing fixtures; it is an addition to the old building and there was only a limited site. The tower is 2 ft. 9 in. square inside, and carried 24 ft. above top floor ceiling, with flag cover at extremity, the outlets being at sides. It serves

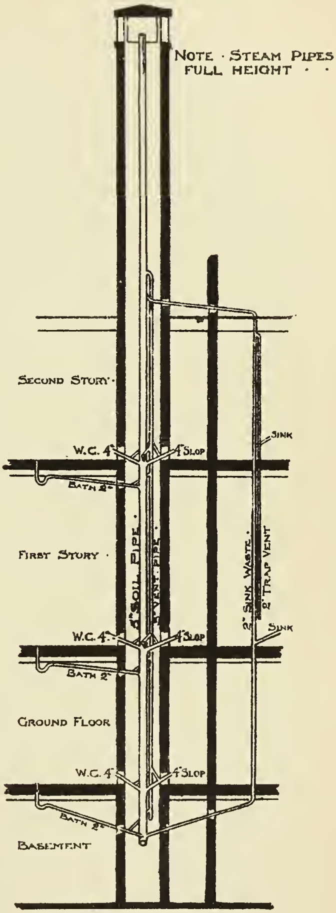
· SANITARY TOWER AND VENTILATING SHAFT

· MASS. GEIZ. HOSPITAL, BOSTON, U.S.A.

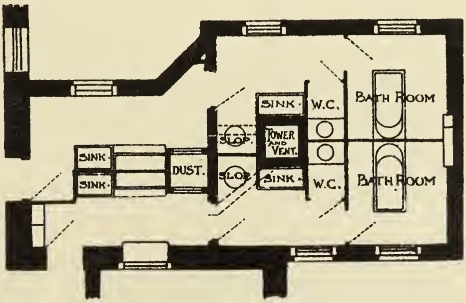
MR CARL FEHMER, ARCHITECT·



· ELEVATIONS ·



SECTION SHEWING SOIL PIPE AND CONNECTIONS



· PLAN ·

SCALE OF FEET · 6 4 3 2 1 0 5 10 15 20 25 30 35 40

Stanford's, Geogl. Estabt. London

for two distinct sets of plumbing fixtures, and allows easy access to all the pipes. Wash-basins, sinks, and water-closets are grouped round it, with the baths between water-closets and end wall. A 5 in. soil pipe is fixed in tower and runs full height, with a 3 in. ventilating pipe parallel to it and turning into it above highest connection. Steam pipes from the heating apparatus are taken up the full height, allowing a good flow and return. All the wastes are separately trapped, and discharge into soil pipe, with vent near connection into main vent pipe. There are 4 in. outlets from water-closet and sink, and 2 in. from bath trap, the waste being under ceiling. The inner sink has 2 in. waste, discharging into soil pipe at bottom, and connected with it as vent above ceiling line of top floor, each inlet into this having separate vent connected with continuation of waste below top ceiling. The pipes were all carefully planned and holes left in the walls; these were afterwards solidly built up. The steam pipes in tower prevent any possibility of the wastes freezing, and cause a continuous upward current of air. There are ventilating flues, exhausting into tower where there is any possibility of smell or steam being offensive.

The water supply to cities is from various sources—ordinarily from the nearest river or lake, which, being at a low level, necessitates the use of pumping stations. At Chicago a tunnel is driven under Lake Michigan, with inlet some distance from the shore, the water flowing to pumping station and there forced up large stand pipe. At Philadelphia the supply is taken from the River Schuykill, quite close to the city, the land for 12 or 14 miles on each side of the river having been acquired and formed into the beautiful Fairmount Park. This park, to some extent, keeps the river free from objectionable drainage, but not altogether, the cemeteries, for example, draining directly into it. Dr. Billings says, in a recent article, that the cities whose water supply is more or less polluted by sewage are so numerous as to form the rule rather than the exception.

It is of some interest to note that although a better water supply is contemplated at Philadelphia, and the reservoirs are partially made, the work has been for the time abandoned, owing, I am told, to causes which unfortunately too often interfere with public works in America, and also to the necessity for the city fathers being economical in everything except the new public buildings, whereon they are lavishing immense sums of money.

The water supply pipes to buildings are of various metals, but ordinarily of drawn lead tinned inside. Seamless drawn brass tubing is largely used, particularly where the pressure is heavy

or the water very soft. For cold water the pipes are tinned inside, but this is not necessary where the water is not used for drinking purposes or for hot water supply. Where exposed to view all brass tubes are coated with tin, plated or varnished with shellac. Wrought iron water pipes are also extensively used, the inside being galvanized, enamelled, lined with tin and occasionally glass lined. Other protecting mediums are of coal tar or paraffin enamel, and of course there are many patent solutions, one having a base of vulcanized rubber. Iron pipes are sometimes zinc-cased outside, particularly when exposed or where possible leak would do injury. In fixing, the horizontal pipes are secured by stout brass bands screwed, while vertical pipes have ears soldered to the pipes and screwed.

It will be understood that the methods of sanitation before described are not in general use throughout the country. The remarkably rapid growth of most of the western cities, and the natural difficulties of the disposal of refuse, conjoined with the general apathy in matters of sanitation, from which both Americans and we ourselves are only just emerging, leave a great deal to be done everywhere, and it must take many years to bring most of the American cities into a thoroughly sanitary condition. Even in so enterprising and wide-awake a city as Chicago, for example, behind the fine houses in its famous Michigan Avenue there is hardly a single house, I am told, where proper provision is made for the disposal of the refuse of the household. The decaying vegetable and animal matter is simply thrown into the unpaved back street, or on to the nearest unoccupied ground and allowed to lie and rot there. At all times these alley-ways are filthy, and in hot weather they are both disgusting and a source of great danger.

But the American public mind is rapidly awakening to a recognition of the necessity for proper sanitation, and, with its hospitality to all new ideas, the inventive genius of the people, and their insatiable desire for "progress," I think it is very probable that they will move much more rapidly than we shall be able to do in our own country, with its conservative instincts and its archæological love for the "dear old cesspool."

[*This discussion applies to the three preceding papers by* Mr. J. V. Edwards, Mr. W. Tattersall, *and* Mr. J. B. Gass.]

Mr. E. C. Robins, F.S.A. (London), was the first speaker. He said he had listened with great interest to the three papers, which were intimately connected with each other, and the various subjects had been

thoroughly considered. They were much indebted to Mr. Gass for his paper on American Sanitation. It was well known that some of the back streets, and also some of the principal streets, of Chicago were a disgrace. He thought the paper read by Mr. J. Vickers Edwards was characteristic of the man; great care had been taken in its preparation. Mr. Gilbert Scott, the celebrated architect, did not know much about sanitation; his mind was occupied with the artistic side of his profession, and very well did he do that part which was particularly his sphere, but sanitary arrangements were left to his subordinates. It was no doubt true that architects, some years ago, had not the knowledge of sanitation that is possessed at present, and they had no inducement to make it their study; but the young architects of to-day would have no such excuse, for much knowledge on all sanitary matters was now open to them, and he thought any architect neglecting to provide perfect sanitary arrangements, could not in future excuse himself on the ground of deficient information. He considered the internal sanitary arrangements of the house should be regarded as a special part of the architect's duty. The drains of houses and public sewers should both be properly separated and dealt with apart from each other. The engineer should consider the ventilation of the sewer important to him, and the architect should consider the ventilation of the house as important to him. With reference to the paper read by Mr. Tattersall, he remarked that the people of this country owed too much to the working classes not to give them pure atmosphere to enable them to carry on their work, and the system of extracting fans recommended in the paper was sound, provided there was a corresponding supply of fresh air.

Mr. M. Ogle Tarbotton, M.Inst.C.E. (Nottingham), congratulated Mr. Edwards upon his excellent paper. He had a most pronounced sympathy with his remarks about heavy and excessive furniture and stuffy rooms.

Mr. Rogers Field, M.Inst.C.E. (London), agreed with what Mr. Tarbotton had said with regard to Mr. Edwards' paper, and said that the influence of a gentleman in Mr. Edwards' position—that of surveyor to the West Riding—must necessarily be very large in advancing sanitation.

Mr. T. Harnett Harrisson (Liverpool) spoke from personal experience as to whether the public appreciated and were willing to pay reasonable rents for well-arranged houses. He had built four, in which he carried out complete sanitary arrangements, but he could not let them at a reasonable rent, because some other houses of a more showy description, and with, perhaps, one room more, could be had for less money. That being so, he asked if the speculative builders were likely to provide better houses for the public until they were more appreciated.

Mr. G. Darley (Leeds) regretted that so few sanitary inspectors were present, and spoke of the difficulty they had to contend with.

Referring to the smoke nuisance, he said that frequently many members of corporations were either manufacturers or iron masters, and consequently they were the very persons whose chimneys created most nuisance, and it was necessary for the inspectors to take independent action. He complained of the scarcity of information on the consumption of smoke. There was great difficulty in connection with the matter, and he hoped that soon some good papers would be read on the subject.

Mr. J. B. Gass (Bolton), speaking with reference to the ventilation of mills, said that the ordinary method was by means of inlets at a low level for the admission of cold or partially warmed air, and outlets near the ceiling or on the roof through which the hot air necessarily escaped. He gave an instance where, on inspecting the ventilation of a mill during the summer months, he found the ventilators for the purpose of admitting air all blocked up with waste, &c., because of the natural objection of the workpeople to the admission of fresh cold air. He referred to one or two cotton mills in America, and also to a large block of workshops in New York, where under the centre of each block is a large ventilating chamber, to which air is brought down through a shaft, the top of which is about forty yards from ground. The fresh air is warmed when required by passing over steam radiators, the amount of steam in the pipes being regulated by a "Fractional Valve": it is then put under pressure by fan into large duct, and distributed to the rooms through galvanized iron ducts, with inlets into the rooms at about eight inches from the ceiling, and having hoods over to spread the air. The foul air is extracted through flues built in walls and exhausted into large flue. Outlets from the rooms are placed near the floor and ceiling, the former being wholly used when warm air is admitted into the rooms; the latter outlet is only used during the very hot weather, and when it is necessary to keep the workshop as cool as possible. The inlets are larger than the outlets, so that during the whole of the time the workshops were in use, and warm air was being admitted, there was a continual outward pressure, and draughts from the windows, &c., were prevented.

Mr. Denham gave an account of the very unsanitary condition in which he had found several large houses, and which he held proved the necessity of a thorough examination of the sanitary arrangements.

Mr. D. Emptage (Margate) said he could not agree with the practice of connecting the wastes and overflows from baths, sinks, and lavatories with the W.C. soil pipe, as was done in America. He thought the system of separate wastes with disconnectors, as carried out in England, was far preferable. The soil pipe should be allowed to receive the discharges from the W.C's. and slop sinks only. He was pleased to find that in Memphis the use of the "Hopper" form of closet was insisted upon, as he considered it to be superior to those kinds which had their trap seals out of sight. The closet referred to

as "distinctly American," the "Dececo," had some good qualities; it was, however, open to the objection that its trap seal was in danger of being lost when large quantities of water were discharged into the basin, and there seemed to be no remedy for this defect without entirely destroying the siphonic action of the closet, which was its main feature.

Mr. W. Tattersall (Bradford) replied to the various observations, and said that the system suggested by Mr. Gass, of forcing warm air into workrooms near the ceiling level, and extracting the foul air at the floor level, would be impracticable in many factories, owing partly to the difficulty of securing proper distribution for the entering air, and more to the difficulty of obtaining outlets at the floor level, sufficient in quantity and in the proper positions, in large rooms the floor spaces of which were almost entirely covered with machinery. As to the operatives being taxed to secure better sanitary conditions, the idea seemed to him impossible, and in his opinion any outlay the employers made in that direction would be amply repaid by the extra amount of work the operatives, who would enjoy better health, would accomplish. Some employers were acting on the enlightened view of the case, with the best results.

Mr. J. Vickers Edwards (Wakefield) expressed an opinion that if manufacturers found persons in earnest about the smoke nuisance they would soon remedy it. He spoke in favour of the use of fans for removing foul air.

The Chairman, Mr. Baldwin Latham, in moving a vote of thanks to the three gentlemen who had read papers, said the sanitation of dwellings was a very important question, and the most hopeful sign of the present day was the interest that the working classes were now taking in it. They were beginning to realise that their health was their capital, and that there was a value in teaching the principles of hygiene and physiology in the elementary schools.

Dr. A. Hill (Birmingham) seconded the vote of thanks, and expressed an opinion that a large amount of the smoke nuisance was owing to carelessness on the part of the stokers, and could be remedied by careful "stoking." The motion was carried unanimously.

SECTION III.

CHEMISTRY, METEOROLOGY, AND GEOLOGY.

ADDRESS,

By William Whitaker, B.A., F.G.S.

Assoc. Inst. C.E.; Assoc. Soc. Medical Officers of Health.

PRESIDENT OF THE SECTION.

Although having to preside over a section that includes three sciences, I must, at the outset, express a hope that no one will expect me to be three single gentlemen rolled into one, able to discourse on chemistry, on meteorology, and on geology. Rather must I follow the advice given to the cobbler, and stick to the last.

I may, however, claim some little connection with all the three branches of science, and it behoves me perhaps to make the most of this. The first of them, chemistry, was the first science that I studied, and once (a long time ago) I thought myself the happy possessor of some fair amount of theoretical knowledge of it. Since then, its language, and one may say its alphabet, has changed; and I should be very sorry to have to undergo an examination in its rudiments now-a-days.

Having led more or less of an outdoor life for nearly thirty years, I may be allowed to have some practical interest in meteorology, as well perhaps as a certain amount of weather-wisdom got by experience and by rough observation.

And here let me put in a plea on behalf of a much abused institution—our English climate, which I am disposed to look on as a fairly satisfactory arrangement; perhaps indeed it would be quite satisfactory if our American friends would leave us alone, or would treat us more justly, by now and then sending us some fine weather instead of always bad. It should be satisfactory to know that much of our bad weather is not a home product, but an importation. To those who would bask in perpetual sunshine, to my mind a most unpleasant way of

spending time, I would quote the words of Charles Kingsley, in his "Ode to the North-East Wind," giving his views of the relation of weather to health, which perhaps are not too well known to meteorologists:—

Welcome, wild North-easter!
Shame it is to see
Odes to every zephyr;
Ne'er a verse to thee.

* * * *

Tired we are of summer,
Tired of gaudy glare,
Showers, soft and steaming,
Hot and breathless air.
Tired of listless dreaming
Through the lazy day:
Jovial wind of winter
Turn us out to play!

* * * *

Let the luscious South-wind
Breathe in lovers' sighs,
While the lazy gallants
Bask in ladies' eyes.
What does he but soften
Heart alike and pen?
'Tis the hard grey weather
Breeds hard English men.

As for geology, the last-named science of our section, it is also the last science that I took up. It has since been my study, continuously, for some thirty-two years, and I am beginning to despair of ever knowing very much about it; for its bounds are ever extending, and at such a rate that the ordinary human mind cannot keep up with it. Indeed, geologists have long been obliged, with comparatively few exceptions (of which I am certainly not one) to limit themselves to certain branches of their science. In my own case some of the more practical bearings of geology have been forced on my attention, by the more or less mechanical nature of much of the work that has fallen to my lot as an officer of the Geological Survey—work that consists essentially of recording facts, or, at least, of doing one's best in that way, some of her facts being much hidden by Dame Nature.

It has been my duty at times to work with Medical Officers, and this duty has been a pleasure also; for it is pleasant to find one's own particular science of use beyond one's own immediate sphere of action. One of these occasions may fairly be alluded to here, as an example of the bearing of geology on large

problems relating to questions of health; in this case to the distribution of certain diseases in certain districts. I refer to the enquiry made by my old friend and fellow-student in geology, Dr. G. Buchanan, now the chief Medical Officer of the Local Government Board, on the Distribution of Phthisis as affected by Dampness of Soil. Having had to report on the effects of sanitary work in certain large towns, Dr. Buchanan unexpectedly found that where, from improved drainage, a decrease of subsoil water had taken place, there the consumption death-rate had also decreased, the most marked example being Salisbury, where the decrease was to nearly a half.

This result led Dr. Buchanan to think that, as artificial drainage caused so great an improvement, it might be found that in districts where, from natural causes, the subsoil was less saturated with water, the death-rate from consumption might be less than in districts where greater saturation occurred.

The further enquiry that was made for the purpose of testing this important question of course involved the examination, in some detail, of the surface-geology of the district selected, as being the one in which alone (at that time) we had the materials for such a work. This district included the whole of the counties of Kent and Surrey (leaving out London), with great part of Sussex, and the enquiry resulted generally in the conclusion that wetness of soil and prevalence of consumption go together.*

Two of the chief problems in matters sanitary are to get good water and to get rid of bad water. Indeed, one may say that when these problems have been solved in any town, at least two-thirds of the work of sanitation have been done.

Our aërial friends may perhaps object to this, and may say that I should be contented with a half, air being of equal importance with water; but I hold that the objection would be itself aërial, and for this reason, that the questions of good and of bad air go together: you cannot get good air without getting rid of bad air, though it is possible of course to replace bad air by other equally bad, or even by worse. With water, however, the case is quite different: a town may have one of the best water-supplies, but its bad water, that is its sewage, may be got rid of

* For full details see Tenth Report of the Medical Officer of the Privy Council, pp. 57–110 (1868); for a shorter account, from a geological point of view, see *Geological Magazine*, Vol. vi. pp. 499-505.

in the worst way; and, on the other hand, another town may have the most complete arrangements for properly getting rid of its sewage, or even for almost doing without that article, but may have a very bad water-supply.

Again, water-supply and sewage must be questions of a more or less public kind, in large places; whilst air cannot be publicly dealt with to any such extent, except as part of sewage arrangements, the ventilation of houses not being yet within the ken of corporate bodies.

With regard to water, it is not only important that populous places should, in the first instance get a good supply; but also that it should be kept good, or, in other words, that sources of pollution should be religiously kept away, a process that entails a careful watch on the doings not only of one's own corporation, companies, &c., but on those of one's neighbours' besides. Undoubtedly the worst thing that can be done with water and sewage is to mix them.

The importance of a good water-supply, and the evil that may result from a bad one, have recently been brought before us in a paper by Mr. G. Higgins,* which treats of the late outbreak of cholera in Spain, showing how its virulence went along with badness of water-supply, certain large towns having been but little affected as compared with others. The author's conclusion may be given in his own words:—"Broadly speaking, it would appear that in Spain this formidable disease never became truly epidemic or dangerous in any city in which there was a pure and good supply of water." In illustration of which, six places provided with good water (in one case a bad supply having been suppressed) are noticed as comparatively free from the scourge, whilst others, with a more or less contaminated supply, were severely visited. So marked, indeed, is this that Mr. Higgins thinks that "when it (cholera) gets possession of the water-supply of a city, no bounds can restrain it; there is but one resource, and that is cutting off the water."

This lesson should be taken to heart by our local governing bodies, who should jealously guard our water from contamination, or indeed from any risk thereof. The immediate saving of money, so popular a notion with many of these bodies, is really a small matter as contrasted with the danger to public health, which may often follow in a not far distant future, from the acceptance of schemes for sewage, for cemeteries, or for other such contaminating influences, on the ground that they "save the rates." I may bring to your notice some schemes, which, originating either in this way or from a want of forethought

* Cholera in its Relation to Water-Supply, *Nature*, 17th June, 1886.

as to their possible result (sometimes indeed from want of knowledge at the time), show the truth of Hood's lines, that

"Evil is wrought by want of Thought
As well as want of Heart."

It occurred to me at first that it might be better to notice the following cases without giving the names of the places where they occurred; but second thoughts, which are proverbially best, suggested that a certain vagueness would result, which might decrease the effect of the whole. It is only fair to say that the cases brought forward are not meant as glaring instances of wrong-doing, actual or projected, some of them referring to comparatively trifling matters; but merely as examples of questionable proceedings of a kind that may often crop up and vex the sanitarian mind. They will be taken in the alphabetical order of the places of occurrence.

Barnet.—Twenty-one years ago an "Absorbing Well," was made for the sewage of New Barnet. It was foreseen that it would hardly do to carry this into the Chalk, the great water-bearing bed of the district, and it was ended in sandy Tertiary beds, between the London Clay and the Chalk. As, however, water is sometimes got from those beds, this proceeding is not without danger. Moreover, there is also the danger of there being some communication between those Tertiary beds and the underlying Chalk, from which the water-supply of the place is got. I believe, however, that this sewage-well has been abandoned. If not it ought to be.

Canterbury.—This city is blessed with a good supply of water from the Chalk, got near the southern boundary, and softened. Lately however, some houses, draining into cess-pools, have been built near by, but unfortunately outside the boundary, and therefore beyond the jurisdiction of the city. Whether any pollution of the water may result is perhaps uncertain; but no one should be surprised to hear that the Water Company has expressed its displeasure at the proceeding.

Fareham.—A somewhat remarkable case of water-pollution has lately been under investigation at the Hampshire Lunatic Asylum, near this town. A bad outbreak of typhoid fever led the Board of Visitors to have a thorough investigation made, and one of our Fellows, Mr. Rogers Field, has, I think, satisfactorily traced its origin to pollution of the water-supply. Having a fair knowledge of the circumstances, I may give a summary of the history of the case, premising that the Asylum was established many years ago, when Sanitary Science had

hardly been invented, so that it is an example of the difficulties that authorities may meet with in old institutions:

1. A dry healthy site was selected on a low chalk hill, with a capping of gravel, and partly bordered by a stream.

2. A well was sunk, and a plentiful supply of good water was got at a moderate depth.

3. The sewage of the Asylum had to be provided for, and this was done, not unnaturally, by distributing it over parts of the grounds, all of which consist of Chalk, capped with gravel at the higher parts.

4. The hundreds of living lunatics in the Asylum having thus been cared for, it became essential also to think of those who died, and a Cemetery had to be established. This also is on the Chalk, and now contains more than 1,500 bodies.

5. The result of a careful investigation, from engineering, from chemical, and from geological standpoints, was to prove that the water of the well was contaminated (as might be expected), and it was shown that the underground flow from the neighbourhood of the cemetery and of the sewage-works was either naturally in the direction of the well, or had been artificially made so by pumping, which pumping, moreover, slightly affects the water-level in a piece of water further from the well than the polluting causes, proving that these are within the cone of exhaustion.

We hear much now-a-days of the germ-theory; but, as far as I know, it has not yet been extended to the propagation of madness; we have not yet heard of the *Bacillus* of lunacy. Should such extension be made, it would seem that the Asylum in question may bid fair to prosper, if increase of business means prosperity, until some other water-supply has been got, as, however, I have no doubt it will be.

Sutton (Surrey).—The Local Board of this place has lately brought forward a scheme for establishing a Cemetery on the Chalk, about three-quarters of a mile from the Waterworks, which get their supply from the Chalk. Strange to say, the Waterworks Company did not oppose the scheme (some ill-natured people said because some of the Directors are also members of the Local Board); but many of the rate-payers opposed it very strongly, being desirous of having water without risk of pollution. I have read the evidence that was given at a Home Office Enquiry, which is of course of the usual conflicting, and sometimes irrelevant, character, and was glad to find the voice of our member, Mr. Baldwin Latham, lifted up against the proposal, as one likely to cause pollution to the water-supply. You will be glad to hear that the Home Office has refused its sanction to the scheme, and perhaps sur-

prised to hear that the Local Board has started another, of just the same kind, for the establishment of a Cemetery within half a mile of the former proposed site, and like it, about three-quarters of a mile from the Waterworks; but with the further advantage of being close to the large Metropolitan Schools, where some 1,500 children are supplied with water from wells in the Chalk. Perhaps a reduction in the number, by means of a possible epidemic, is looked on as a method of affording relief to the rate-payers of London.

One cannot help wondering what would happen were the Waterworks in the hands of the Local Board, and a Company proposed to establish Cemeteries on either of the suggested sites!

The question of burying-grounds leads one to ask whether it is right that the living should be sacrificed to the dead? Will there never be an improvement in our present horrible way of dealing with the latter? That subject, however, it is not my business to discuss;* enough to enter a protest against the establishment of cemeteries on great water-bearing formations, and near waterworks.

Swaffham.—One day when working on the Geological Survey in Western Norfolk, I had occasion to look at a certain chalk-pit within two miles of this little town, my interest in which was augmented by seeing, in the distance, signs of moisture in the bottom, where, from the height of the place, no such signs should be, the saturation-level of the Chalk not being near the surface. I hastened down hill to this quite unexpected occurrence, and suddenly found myself in ground soaked with moisture of a distinctly unpleasant kind! My nose (and most people can speak through the nose) said sewage! and I quickly evolved the theory that Swaffham drained itself into this chalk-pit, a theory that, unlike many others, survived the test of enquiry. Luckily this sewage-pit is not in the line of flow of underground water to the town, which is supplied from a well in the Chalk, and luckily, too, it is some way from houses. As, however, we know little about the distance to which sewage in bulk may flow underground with retention of polluting power, I look with some interest on the Swaffham experiment. Any one wishing to see this experiment will easily identify the spot, which touches a road, by scent.

Tring.—I will now allude to a case referring to surface water-supply, for information on which I am indebted to my colleague Mr. Jukes-Browne. Part of the drainage of this town is carried away by a sewer which empties itself into the canal-reservoir to

* It was the first subject discussed in Section I., p. 77.

the north. Before this sewer was made the reservoir received only spring-water, a matter of some importance, as some neighbouring villages drew their water from the stream that flows from the reservoir. After the turning in of the sewage, in summer, when the water in the reservoir was low, it stank abominably; and worse, diphtheria, typhoid fever, and other such diseases, were frequent in the villages. This has lasted for years; but I hear that the Local Board have at last adopted a scheme to treat the sewage by broad irrigation, on land between the reservoir and the canal, and that the process is to begin this month. Whether it will be perfectly effective or not may be a matter of doubt, and very likely the question of the water-supply of the villages may crop up again.

The course along which we have now gone can hardly be called a pleasant one. It is not, however, the object of this Congress to take you along such paths, but rather to show evil ways, and to lead to their improvement. Yet I would like to call your attention to a subject that will perhaps prove to be very important, and that, so far, shows that some processes in every day use in many waterworks may turn out to have a beneficial effect in a way never dreamt of when they were started. The processes alluded to are *filtration* and *softening*. The subject arises from a paper by Dr. P. F. Frankland, published only last July,* in which it is shown that filtration not only fulfils its object in separating solid particles from water, but also reduces the number of micro-organisms in the water, the reduction going even to the extent of entirety at the very first, but, in most cases, greatly decreasing after prolonged action. Iron-sponge and coke are exceptions to the great decrease in this power, and are by far the most effective substances. It is noteworthy that this power of stopping the passage of micro-organisms is possessed by substances that have hardly any chemical action on water. Of course, Dr. Frankland's experiments emphasize the need of the frequent renewal of filtering materials.

It is found too that micro-organisms are thrown down from water by agitation with particles of solid matter; and here again coke is to the fore, closely followed by charcoal and by chalk. If, however, the water be left long with the deposit thus thrown down, a re-ascension of organisms, and their consequent multiplication, take place.

A like purification is also brought about by chemical precipitation, a fact of great practical importance, such precipita-

* Water-Purification; its Biological and Chemical Basis. *Proc. Inst. Civ. Eng.*, vol. lxxxv., p. 197.

tion being conducted, on a large scale, in the process for softening water from limestones, such as the Chalk, by the addition of lime-water, causing deposit of calcic carbonate in a finely divided state. This process, strange to say, has a greater power biologically, in removing organisms, than it has in chemical purification.

The questions as to what harm micro-organisms may do in water—whether some are bad, some good, and some indifferent, and which are which—cannot be here discussed. They belong to another Section. One of our members, however, claims to have taken over 23 millions of them in 18 months, I believe with no evil result; but then he took them in hot water, which, perhaps, they may have relished less than he did, and it is not stated whether he took the water without accompaniment.

It occurs to me that this may be a fitting occasion to advance a plea for a certain set of scientific men: I mean those who often have to apply their science to practical purposes. Surely those who do their best to apply science to the public good are entitled to some credit, and should not be slighted, as there is sometimes a tendency for them to be, by those who, from various reasons, are enabled to follow the purely scientific bent of their own minds, to give up their time to the delightful pursuit of knowledge in the abstract, and, as it is often put, to study science for its own sake, which perhaps sometimes means that a man does what is pleasant to himself without particular thought of anybody else! Some applyings of science, on the other hand, are hardly likely to be to any one's taste, and, at all events, the ways of sanitary science do not always lead to pleasant places.

Again, I would ask—What is the use of knowledge? Is it merely to be looked on as educational—as improving the mind? Is not the body to be thought of? And is the proverb, *mens sanâ in corpore sano*, to hold only for the individual? Does it not apply to the body politic?

Great researches and discoveries are beyond the power of many of us—of nearly all of us. We cannot all start and establish great theories, largely affecting the progress of science; but we can all do some little to advance knowledge, and with careful observations of facts, followed by fair inferences drawn from those facts, we may help the generalizers of the future. We cannot all be Newtons or Darwins; but we can all do something for the good of our fellow-creatures.

Ald. Rowntree (York) moved a vote of thanks to the President of the Section for his address. The President had concluded by saying that we could not all be Newtons or Darwins, but he had shown that he had one point of similarity with Newton, and that was the great modesty that characterised his opening remarks, reminding one of Newton's observation of how comparatively little he knew. But as they had listened they had heard sufficient to show that the President knew a great deal, and a great deal which would be valuable to them all. They were all concerned in the purity of the water supply of their different localities. The citizens of York were interested in it. The history of their water supply was an interesting one, dating back two centuries ago, when it was drawn from the river and distributed in the city in wooden pipes—trunks of trees—which were still occasionally dug up in the streets. Writers on the health of the city last century had spoken of the distribution of the unfiltered water, and particularly when taken during a flood, of its thick nature, as one of the causes which injured the health of the city. The gradual improvement in the supply, the extension of the waterworks, the taking of the water from a greater distance, and then the application of filtering, had all acted beneficially on the health of the city.

Mr. S. W. North (York) seconded the vote of thanks, which was carried by acclamation, and acknowledged by the President of the Section.

On "Open Spaces and Physical Education," by Lord Brabazon.

"Civium Vires Civitatis Vis."

Of late years a marked increase has taken place in the number of Urban Parks, Gardens, and Playgrounds of the United Kingdom which are accessible to the public. This activity on the part of municipal authorities and of philanthropic Societies and individuals, is largely owing to the growth of a public opinion favourable to the creation of pleasant oases, refreshing to the mind and body, wherever the undue extension of bricks and mortar has banished man from the humanizing influences of nature, and has turned the soil into a stony wilderness. The credit of giving the impulse which set this public opinion in motion is due in a great measure to Miss Octavia Hill. She it was who in season and out of season was never weary of preaching, often to deaf ears, the importance of open spaces for the benefit of the poor, and especially of their children. She it was who first put into practice the principles she preached,

and turned a fetid London court into an "open-air drawing-room." Her example has been largely followed. Within the short space of three years the Metropolitan Public Garden Association, through the generosity of the public, has alone been enabled to throw open to the people of London four playgrounds and seventeen gardens, and of these one of the former and one of the latter have been permanently transferred to the care of the local municipal authorities. This transference of open spaces, from the care of an Association supported by voluntary subscriptions to that of a public body like a local Vestry or District Board, means, of course, an increase (though an infinitesimal increase) of the rates, and there are those who, from not thoroughly appreciating the important issues involved in the matter, question the justice or the propriety of a public authority increasing the burdens of the people for what they consider to be a luxury rather than a necessity. Such a doctrine will find no support at my hands, even supposing these open spaces could be regarded as simple luxuries. I believe that there are luxuries of a public character, such as Museums, Art Galleries, &c., which the Government of a rich and prosperous nation is justified in providing for the benefit, refinement, and enjoyment of the people committed to its charge; but the question will arise, can Parks, Gardens, and Playgrounds—means for the preservation of the public health—be considered luxuries? Should they not much more justly be ranked among public necessities? Health is one of the first of these, and in my opinion no expense should be spared, and no opportunity neglected, to increase the average standard of the nation's health and strength. If a people's average standard of vitality be lowered, that people will assuredly be handicapped in the race of nations by as much as that standard has been lessened. The health of the mind is largely dependent on the health of the body; and although occasionally a powerful and healthy brain may be found in a diseased body, the mind and body act and react one upon the other. So that a nation (and it should be remembered that a nation is nothing more than the aggregate of the men and women composing it) will only have as much muscular power, and brain-force, as may be the sum-total of these qualities possessed by the men and women of which it is formed. A simple reference to the last census returns will show that this country is increasing at the rate of 300,000 a year, and that these 300,000 are not added to the country population, but are absorbed by the large overgrown cities of Great Britain and Ireland. Now it is a well-known and universally recognised axiom of hygienic science, that other things being equal, the health of a population is in inverse ratio to its

density; in other words, that the more the people are congregated together, the more unhealthy do they become. This being the case, it will be readily seen that *unless steps are taken to counteract the operation of this natural law, the inhabitants of our towns must degenerate in health*, which is as much as to say that this is the destined fate of two-thirds of our population; for at this moment there are in Great Britain two men living in towns for every one living in the country. Now what are the most obvious steps to be taken to counteract this natural tendency of disease to dog the steps of men when crowded together? Why, to open out the population as much as possible; or, if this cannot be done, at all events to break up these dense masses of humanity, by intercepting them wherever and whenever possible with open spaces. If this be the first remedy, then surely it is the duty of those who are the guardians of the public health to provide such open spaces? For individuals cannot be expected to buy them for the general good, and in no way, in my opinion, could public money be more legitimately spent than in thus preserving and improving the health of the community. I trust I have clearly shown that the providing of public gardens and open spaces in large towns is no question of ornamental luxury, but one very closely connected with the health of the people, and, as such, should be considered a most legitimate object for the expenditure of public money.

If it be right that the people inhabiting our large towns should be provided at the public expense with parks, gardens, and playgrounds, for similar reasons I think many will agree with me that, where possible, gymnasia should be attached to elementary schools, and that systematic instruction should be given to the children in gymnastics and calisthenics. The body should be trained as well as the brain. At present, our system is entirely a one-sided one. We starve the body and overwork the brain, and the former takes its revenge on us by refusing to nourish the latter. The brain, unable to bear the strain, which would be no strain if the body were properly cared for, frequently breaks down, and broken health ensues, followed sometimes by insanity and even death. Germany and Switzerland, as well as Norway and Sweden, have for long been alive to the necessity of caring for the body in order to get the best work out of the brain; and although the inhabitants of these states, being mostly country bred, are not in such urgent need of physical training as are the populations of our crowded towns, the sums expended by the governments of these nations on the compulsory gymnastic training of the young would appear incredible to the educational authorities of this country. Whilst

I have been writing, the physical aspect of the education of women has occupied the attention of the British Medical Association, and its President, Dr. Withers Moore, has been giving the following strong expression to a belief that women are suffering through over-pressure in brain-work whilst at school and college: "From the eagerness of woman's nature," says Dr. Withers Moore, "competitive brain-work among gifted girls can hardly be but excessive, especially if the competition be against the superior brain-weight and brain-strength of man." "They require," he asserts, "to be protected from their own willingness to study," and how, we may add, can they be better protected than by being encouraged to turn some of their energies towards the improvement of their physical natures by means of calisthenic and gymnastic exercises, or by healthy open air games suitable to their sex. In a pamphlet which has lately appeared, Mr. Alexander, Director of the Liverpool Gymnasium, discusses the provision in England for physical education, points out its inadequacy in every respect, and states what are the nature and extent of the required reforms. He maintains that there are many teachers in charge of existing gymnasia who would be glad to have their services utilised in the day-time; that the obstacle to physical training is the eagerness with which result fees are looked after, so that the teachers cannot spare the school children during the day. Surely the remedy for this is to include gymnastics in the school course, and to grant fees for successful physical as well as mental training, say in accordance with the school average width of chest. Mr. Alexander says, "Let there be a central training school, whose certificates will be granted to those who pass an examination of proficiency; let there be a code of exercises decided upon of a light, recreative, and popular character, with plenty of mental stimulus about them, as there should be about all exercises; let the exercises be useful, such as swimming drill, by which children can be thoroughly practised in the movements before they enter the water, thus facilitating their swimming lesson. If the Education Department will not give the necessary half-hour per diem for this, then at least give it directly after school hours, and watch the beneficial result that will surely take place. One or two professional instructors could visit the schools in each town, in order to keep up the standard of efficiency, and inspections could take place at convenient periods. *The experiment to have a fair chance should share in the result fees.*"

To show that it would be an easy matter to calculate the result fees to be given for average increase in circumference of chest in consequence of gymnastic training, I annex a form

prepared by Dr. W. P. Brookes, of Much Wenlock, who for many years has taken a deep interest in the question of physical training, and by which it will be seen that from statistics taken in the Much Wenlock National School for six months from August 21st, 1871, to February 21st, 1872, in the case of six boys who went through a course of drill and gymnastic training, consisting of the use of Indian clubs, the vaulting horse, horizontal and parallel bars, the average increase in chest circumference was $1\frac{5}{6}$ inches, or nearly 2 inches; whilst in the case of six other boys who went through a course of instruction in drill alone, it was but $\frac{11}{24}$ inches, or not quite $\frac{1}{2}$ an inch. I shall produce one more witness to the necessity for physical training, namely, Dr. George Fletcher, who has had large experience as a medical officer. In a paper on the "Management of Athletics in Public Schools," read before the medical officers of schools in January last, Dr. Fletcher insists that a large amount of exercise in pure air is required to keep lads in bodily health; and he contends that all games and physical exercises in schools should be regulated and under supervision. The experience I have gained as Chairman of the Metropolitan Public Garden Association has shown me the wisdom of this remark. Ordinary town lads are unacquainted with the games in which English school-boys of a higher social grade delight. Their ways are rough, they are unaccustomed to discipline; and if turned loose into a playground without supervision, are unable to avail themselves of the advantages offered there. Their sport degenerates into bullying or horse play, with no good physical result. Gymnastic apparatus under these circumstances becomes a positive danger, and broken heads, arms, and legs are certain to be the result if the lads are allowed to use them without supervision or instruction; but under a good teacher they soon learn discipline, enjoy themselves, and become as keen followers of organised games as any school-boy at Eton or Harrow. Dr. Fletcher's words are: "It should be remembered that, as regards compulsion in games, bodily exercise should be as carefully supervised by the masters as mental exercise; for it is not wise that boys should be left to manage these physical matters entirely by themselves, thinking that you can trust Nature and all will come right, and that the boy for whom exercise is desirable will be prompted by Nature to take just the amount required for his health. No such thing. In the general routine of lessons, a boy is compelled to conform to certain rules for the education of his mind; this is not here left to Nature nor to the boy's disposition, for if it were, there would, in most instances, be a miserable deficiency of brain exercises, or, in a few rare cases, a mischievous excess. If a boy

does not like his Virgil or his Euclid, his masters do not leave him to take what he likes of these subjects. He is compelled to enter into them, and to get through a certain amount, and often will soon excel in some branch of study from judicious compulsion. So with games, do not allow the boy to play only when he chooses; at any rate, you are improving his bodily vigour, and he has had every chance of excelling in some branch of athletics. Let it fairly be instilled into the minds of parents by masters, that the education of the *body* is not far behind the education of the *mind* in importance, and the *amount* and *kind* of exercise both of mind and body should be always considered together."

Englishmen as a rule do not look to the Government to introduce reforms unless these reforms are first demanded by a large section of the community. This characteristic of the national temperament has its strong and also its weak side. If on the one hand it makes the people self-reliant, on the other it is a distinct discouragement to the spirit of amendment in governing bodies, who, instead of being continually on the alert to discover and put into practice improvements in the management of their different departments, as a rule consider it rather the duty of an official to throw cold water on all suggested innovations which threaten to alter the orthodox routine of work. The result of this customary apathy on the part of our officials makes it necessary for reformers to acquire popular support before bringing the question of any reform to the notice of governing bodies, and in order to obtain this support, the public must be educated and urged to action, by the subject requiring reform being constantly presented to their attention. Bearing these facts in mind, those of us who believe that in order to preserve the national health and physique at the proper standard, reforms in our system of education and in the management of our towns, are imperatively demanded, should not be disheartened because so little apparent progress would appear to be made in the popularisation of the national hygiene and of physical training, but should lose no opportunity of promulgating their views on the platform, through the press, and by all those means of spreading information which modern civilization affords. Action has already been taken in this direction by the Manchester Open Spaces Committee, and by the Metropolitan Public Gardens Association. The former has obtained the signatures of many influential and eminent men, including the names of H.R.H. the Duke of Cambridge, and General Lord Wolseley, to a petition urging the appointment of a Royal Commission to consider the question of physical training, and the latter body has sent the following memorial on the subject

to the Education Commission, and a somewhat similar one to the London School Board:—

To the Right Hon. Sir Richard Assheton Cross, M.P., G.C.B. (Chairman), and the Members of the Royal Commission on Education.

The Memorial of the Members of the Metropolitan Public Gardens Association,

Respectfully sheweth—

That your memorialists are of opinion that increased facilities for the physical training of the young of both sexes, and further provision for their wholesome recreation are much needed in all the larger towns of the United Kingdom, and feeling that this is a subject which is within the lawful scope of the enquiry of the Royal Commission on Education, they humbly beg to urge its consideration.

They base their belief upon the following grounds:—

1. That physical training is not at present one of the obligatory subjects for the ensurance of a Government grant in elementary schools.
2. That several teachers in Board or Voluntary schools are unable to give instruction in gymnastics or calisthenics either in the playgrounds or rooms of the schools.
3. That there is a want of some fund from which the maintenance, out of school hours, of existing playgrounds can be defrayed.
4. That there is great difficulty in obtaining, in densely populated districts, adequate open spaces for public recreation.
5. That there is a marked difference in bodily health and vigour, and in a pre-disposition to disease and immorality, between the young in the country and those in towns.

They believe that these difficulties might be overcome in the following ways:—

1. By the alteration of the Code of Education, so that physical training should be included among the obligatory subjects, and in this way necessarily introduced into each department of every elementary school.
2. By assistance given towards the introduction of instruction in physical training into the curriculum of all training colleges.

3. By the enforcement of a regulation that all playgrounds in connection with public elementary schools should be kept open, *under supervision*, for the use of the children and young people of the neighbourhood between and after school hours.
4. By the grant of further powers to local public bodies for the purchase of land for open or covered gymnasia, and for suitable recreation grounds for the use of the general public.

They believe that if these suggestions were carried out the following results would ensue to the rising generation:

1. A decrease in juvenile mortality, a better physical development, and a greater amount of bodily health.
2. An increase in the mental powers.
3. A decrease in crime, drunkenness, and immorality.

It is therefore the earnest desire of your memorialists that the members of the Royal Commission on Education should take this matter into their serious consideration, and consent to hear evidence upon the need of better means for physical training and increased facilities for wholesome recreation in all towns.

And your memorialists will ever pray, &c.

A National Physical Recreation Society has lately been established for the promotion of the physical education of the working classes, under the presidency of Mr. Herbert Gladstone, M.P., supported by the Hon. A. F. Kinnaird, Colonel G. M. Onslow (Inspector of Military Gymnasia), Lord Charles Beresford, M.P., The Hon. T. H. W. Pelham, and Mr. T. C. Edwardes-Moss, M.P., of athletic fame, with Mr. A. Alexander, F.R.G.S., Director of the Liverpool Gymnasium, as Honorary Secretary. An association with such influential leaders should be able to work wonders in the improvement of the physical education of the people; and in the confident hope that at no distant period the bodies of the poorer children of this country will be as well cared for as their brains, I ask those who hear me to-day to assist in forming a public opinion favorable to the maintenance by Municipal Authorities of open spaces, playgrounds, and gymnasia in towns, and to such alterations in the Education Code as will bring up a generation of English men and women, physically capable of bearing the burden of the high civilisation and extended Empire they have inherited from their forefathers.

APPENDIX.

Statistics of the Drill and Gymnastic Training given to twelve boys in the Much Wenlock National School, from August 21st, 1871, to February 21st, 1872.

Drill and Gymnastics.

Increase after Six Months in the Circumference			
Boy.	Of Chest.	Of Upper Arm.	Of Fore-Arm.
	Inches. Inches.		
1	From $27\frac{1}{2}$ to $28\frac{3}{4}=1\frac{1}{4}$ in.	$\frac{1}{4}$ inch.	Nil.
2	„ 28 „ $29\frac{3}{4}=1\frac{3}{4}$ „	$\frac{1}{2}$ „	$\frac{1}{4}$ inch.
3	„ 30 „ $31\frac{3}{4}=1\frac{3}{4}$ „	$\frac{1}{2}$ „	Nil.
4	„ $27\frac{1}{2}$ „ 29 $=1\frac{1}{2}$ „	$\frac{1}{2}$ „	Nil.
5	„ $28\frac{1}{4}$ „ $30\frac{1}{4}=2$ „	$\frac{1}{2}$ „	Nil.
6	„ $27\frac{1}{2}$ „ $30\frac{1}{4}=2\frac{3}{4}$ „	$\frac{3}{4}$ „	$\frac{1}{2}$ inch.

Average increase in circumference of chest $1\frac{5}{6}$ inches, or nearly 2 inches.

Exercises: Indian clubs, vaulting horse, horizontal and parallel bars.

Drill Alone.

Increase after Six Months in the Circumference			
Boy.	Of Chest.	Of Upper Arm.	Of Fore-Arm.
	Inches. Inches.		
7	From $24\frac{1}{2}$ to $24\frac{3}{4}=\frac{1}{4}$ in.	$\frac{1}{4}$ inch.	Nil.
8	„ $27\frac{1}{4}$ „ $27\frac{3}{4}=\frac{1}{2}$ „	$\frac{3}{4}$ „	$\frac{1}{2}$ inch.
9	„ $29\frac{1}{2}$ „ 30 $=\frac{1}{2}$ „	$\frac{1}{4}$ „	$\frac{1}{4}$ „
10	„ $26\frac{1}{4}$ „ $26\frac{3}{4}=\frac{1}{2}$ „	$\frac{1}{4}$ „	Nil.
11	„ $25\frac{1}{2}$ „ 26 $=\frac{1}{2}$ „	$\frac{1}{4}$ „	$\frac{1}{4}$ inch.
12	„ $25\frac{1}{4}$ „ $25\frac{3}{4}=\frac{1}{2}$ „	$\frac{1}{4}$ „	Nil.

Average increase in circumference of chest, $\frac{11}{24}$ inches, or nearly $\frac{1}{2}$ inch.

(Signed) W. P. Brookes, *Trustee.*
Edward Stroud, *Schoolmaster.*

Mr. S. W. North (York) said if persons lived in too close proximity to each other, their health was sure to suffer, therefore the question of open spaces resolved itself into one of the elementary principles of public health. No community could possibly do its duty if it did not take in the construction of towns. Streets should be of reasonable width, and public bodies did a great injustice when they allowed streets with "dead" ends, thus preventing a proper circulation of air. He also spoke in favour of gymnastic exercises as a means of aiding to promote health, and referred to the benefit which men who joined the army received from drill and the work in the gymnasium.

Surgeon-Major Black (Edinburgh) corroborated the statement of the last speaker as to the beneficial results of drill and gymnastic exercises in the open air upon the health of the soldiers, stating that such exercises and drill had been proved to have stopped the seeds of consumption from germinating fully.

Surgeon-Major Pringle (London) gave his testimony in the same direction, and said that Lord Brabazon had done a noble work in converting practically useless places in towns into recreation grounds, which acted as lungs to the poor.

Mr. C. Roberts (London) thought that girls needed gymnastic exercises as well as boys, and thought there was a danger when these exercises were pushed too far, especially when they assumed the form of military drill. He supported Lord Brabazon's view that open spaces in towns were most valuable.

Ald. Rowntree (York) thought it would be interesting if someone would state what had been the practical means adopted in the localities where Corporations had taken over the charge of burial grounds and open spaces, for securing their proper oversight. The Corporation of York were the owners of the moats and grounds round the walls, and there had been a considerable desire among the people to have them opened for the use of the children. What had stood in the way was the inability to find a practical way for keeping these places under proper oversight. There was in this city a very interesting illustration of the care taken of open spaces by local bodies in the past. It was related that a great struggle took place between Queen Elizabeth and the Corporation in regard to the keeping open of St. George's Field, near Skeldergate Bridge, in which the Corporation were, happily, successful, and the Queen surrendered her claim. The citizens of York, therefore, had reason to be thankful for the pertinacity of their ancestors in the Corporation.

Mr. G. J. Symons, F.R.S. (London), expressed the pleasure with which he had heard Mr. North's views against streets with "dead ends," as the *cul-de-sac* was called. Such streets could not have what all streets needed, a "flushing" of air, and he trusted that Corporations would do all they could to abolish such places in future.

Dr. EWART (Brighton) held that the cry for open spaces was only part of a "system," requiring fuller development for the sanitary and hygienic amelioration of the general conditions and surroundings of all classes of the community, and he suggested that other remedies were required besides open spaces to make healthful populations; particularly in the construction, ventilation, and sanitation of the so-called homes of our labourers and artizans.

The Chairman, Mr. W. WHITAKER, gave his opinion from experience, that drill was most beneficial.

Alderman RYMER (York) asked for information respecting the care-taking of open spaces formed under Lord Brabazon's auspices.

Thanks were voted to Lord Brabazon.

"*On Medical Climatology: a Scheme for defining Local Climates by combined meteorological and phenological observation,*" *by* CHARLES ROBERTS, F.R.C.S., &c.

WE must not confound the study of climatology with that of meteorology. Meteorology is the science of the atmosphere in its purely physical aspects, but climatology is the science of the atmosphere in its physical, chemical, and biological aspects, and also of the physical, chemical, and biological aspects of the earth's surface in contact with it. Meteorology deals with the weight, temperature, aqueous vapour, movements, and electrical condition of the atmosphere—in one word, with the weather—but in addition to the weather, climatology deals with the quantity and quality of the air, the sunshine, and the soil. If to these numerous elements we add their influence on the human body in health and disease, we have the very comprehensive science of medical climatology.

There is a very decided difference in the methods of investigation of the meteorologist and the medical climatologist. The former deals principally with averages, the latter with extreme meteorological conditions. Living organisms have the power of accommodating themselves to a considerable range of variations in external conditions, and it is the limits of these ranges of variation which are of importance to the medical climatologist. Or to put the question in another form, living organisms vary with the physical conditions to which they are subjected; and hence different organisms declare and embody the different conditions to which they have been exposed, and this is true of geological as well as meteorological conditions.

Now, if we examine the whole range of living things we shall find that plants are most exposed to, and most distinctly declare the geological and climatic conditions of a country or district. Being fixed to the soil, they show its character; and being confined to one place they sum up the whole range of meteorological phenomena to which they are and have been exposed. The tolerance of different species of plants for different amounts of temperature, rainfall, sunshine, atmospheric impurities, &c., constitutes them veritable "weather glasses" of different degrees of sensibility, from which we can gather a more distinct idea of the climate of the place in which they survive than from any number or combination of meteorological instruments: hence the advantages of the phenological method of studying climate.

The idea is by no means new. Linnæus was fully aware of its utility, and set some of his most distinguished pupils to collect observations, not only on the geographical distribution of plants, but on the four most characteristic phases of plant life, viz., leafing, blossoming, fruiting, and the fall of the leaf, in individual plants. Several "Calendars of Flora" resulted from these early enquiries.

In 1844 Mr. Quetelet, the distinguished Belgian astronomer and meteorologist, put forth a large scheme for determining the periodic phenomena resulting from the change of the seasons and climatic causes, which was considered and revised to suit our British flora and climate by a committee of the British Association (consisting, among others, of Professors Owen, E. Forbes, Ball, Allman, Babington, Dr. Lankester, &c.), and was published in the Reports for 1845. The scheme was a very elaborate one, requiring observations on nearly 600 plants, animals, birds, and insects, which placed it beyond the range of most people's powers, either to identify the objects, or keep a record of the phenomena they displayed. The chief advantage of the scheme is the careful definitions of the most suitable objects for phenological observations, and the best methods of carrying out such observations.

For several years past a Committee of the Royal Meteorological Society has been collecting observations on a much shorter list of plants, birds and insects, confining its attention to the one phase of the blossoming of wild plants, and the first appearance of a few insects and the most regular of our migratory birds. The disadvantage of this scheme is that it embraces too many objects and too few phases of plant life, and covers little more than half the year, and it does not demand any concurrent meteorological observations.

Last year (1885) a short scheme was published by Dr. Hoff-

mann, of Giessen, based on the results of his own forty years' observation, and on the data collected from registers kept at about 2000 stations in various parts of Europe, including 200 in the British Isles. This scheme comprised a few common trees and shrubs which require no botanical skill to identify, and embraces all the four phases of plant life recommended to be noted by Linnæus and Quetelet. Its defect, as that of all other schemes previously propounded, is in the absence of recognition of the importance of corresponding meteorological observations which would show the relative climatic value of the phenological records.

Last year I received from the Rev. T. A. Preston, of Marlborough, a series of observations made on the blossoming of plants, the migration of birds, and the appearance of a vast number of insects, and with them a series of meteorological tables covering the same period of time (the 20 years from 1864 to 1884). By working out the averages of both sets of observations, and arranging them side by side for every day of the year, I have shown—as far as averages can be trusted—the temperature and moisture equivalents of the blossoming of each plant, and the appearance of each insect. This has been done by working out the accumulated temperatures above 42° (the assumed zero of vegetation by botanists) by the rules laid down by the Royal Meteorological Society; and the accumulated rainfall, by distributing the monthly rainfall equally over every day of the month, and adding it up for every day of the year in succession from the 1st January. This is, I believe, the first attempt which has been made to correlate meteorological and phenological observations.*

It would not be a difficult task to construct short lists of plants, &c., to represent the various meteorological elements separately, and with a prospect of obtaining results from them which would be of great value to medical climatology.

1. The different elevations of a country are distinguished by different species of plants and trees, but as our country does not possess decided variations of this kind it is unnecessary to give such a list here. The retardation of vegetation is sufficient for this purpose.

2. A list of plants, even within a single natural order, such as Ranunculaceæ (*i.e.*, Marsh Marigold to the Traveller's Joy), could be constructed to show the relative dampness or dryness

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* For a full discussion of this subject see the introduction to my "Naturalist's Diary: a Day-book of Meteorology and Phenology." Sonnenschein & Co., London, 1886.

of the soil and atmosphere of two districts, but the rainfall and atmospheric humidity are best dealt with in conjunction with temperature.

3. The lowest range of temperature of a district is of great importance in connection with many diseases and the selection of suitable winter health resorts, and the simple survival of many sub-tropical plants in temperate regions is a valuable indication of the general climatic conditions. The following list has been drawn up from my own observations at various Mediterranean health resorts. The observations should relate to the (A) growing, (B) blossoming, and (C) ripening of fruit. Many of these plants will grow in other than their native situations but will not flower, while others will grow and blossom but will not ripen their fruit. These facts should be noted.

Adam's Needle (*Yucca gloriosa*), A, B, C.
Almond (*Amygdalus communis*), A, B, C.
Aloe, American (*Agave Americana*), A, B.
Bamboo (*Bombusa vulgaris*), A.
Banana (*Musa sapientum*), A, B, C.
Camellia (*C. japonica*), A, B.
Fig-tree (*Ficus carica*), A, B, C.
Gum-tree (*Eucalyptus globulus*), A, B.
Juniper (*Juniperis communis*), A, B, C.
Lemon (*Citrus Limonum*), A, B, C.
Magnolia (*M. grandiflora*), A, B.
Maize, A, B, C.
Myrtle (*Myrtus communis*), A, B.
Oleander (*Narium oleander*), A, B.
Olive (*Olea Europæa*), A, B, C.
Opuntia (*O. ficus-indica*), A, B, C.
Orange, sweet (*Citrus aurantium*), A, B, C.
Palm, dwarf, European (*Chamærops humilis*), A.
Pomegranate (*Punica granatum*). A, B, C.
Vine (*Vitis vinifera*), A, B, C.

4. We possess no ready means of testing the relative purity of the air. The ozone tests fail us at the very outskirts of towns and manufacturing districts, and chemical analysis is difficult and not always satisfactory. Here the growth of plants is of great value, as different species possess different degrees of sensibility to atmospheric impurities of both a chemical and mechanical description. The diagram on page 273 shows the relative viability of a few common trees, shrubs, and flowers in London and its neighbourhood, the result of my own four years' observation.* Each square represents an area in which the plants included in it will grow, but in which the plants represented in the next square would not survive. The scheme comprises four different groups of plants: deciduous trees, evergreens, coniferous trees, and common garden or window flowers. It is not necessary that observation should be made on all of them, and preference, if any, should be given to deciduous trees. The scheme will be applicable to large manufacturing areas as well as to large towns.

* For a similar set of observations see R. Garner, Rep. Brit. Assoc., 1863.

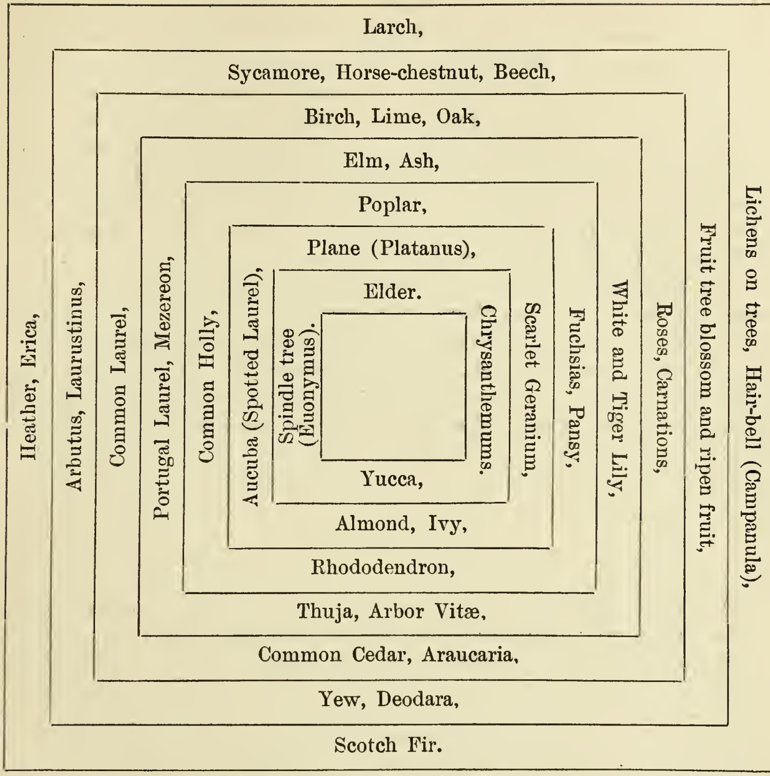

Diagram showing the sensitiveness of different species of trees and plants to chemical and mechanical (soot, &c.) impurities of the atmosphere of towns and manufacturing districts.

5. Prevailing winds are indicated by the inclination of trees, especially of rapid growing ones like the common poplar, and by the greater freedom from moss and lichens on the weather aspect of exposed trees, especially of the pine family. Near towns, soot on the stems of trees indicates the direction of prevailing winds. Round the coast, and especially on the eastern side of England, trees lean inland from the injury done by sea breezes; but inland the south-west aspect of trees suffers most from winds. This is a subject which is deserving of more attention than it has yet received.

6. The presence or absence of sunshine is indicated by the relative prevalence of leaves and flowers. But this question is largely dependent on rainfall, as a large rainfall not only produces an excess of leaves, but, being accompanied by clouds,

the sun becomes obscured by them. Sunshine is also related to temperature, and as a low temperature is shown by the postponement of the blossoming of flowers, and especially by the deficient ripening of fruits, the quantity and quality of the sunshine is indicated by ordinary phenological observations.

The schedule on page 275 has been constructed from the trees and plants included in Dr. Hoffmann's scheme. A few plants have been omitted as they are little known in this country, and I have added the almond as the best representative we possess of the early blossoming wall-fruit trees.

By making simultaneous observations in various parts of the country and recording them on this schedule, it will be possible to lay down on a map several *isophenal* lines similar to, but by no means identical with, the isothermal lines laid down by meteorologists, and thus show at a glance the stations which possess corresponding climates, and the amount of difference between others.*

Mr. G. J. Symons, F.R.S. (London), referred to the paper as being one in connection with a greater work which Dr. Roberts was doing, and said that in these labours he was perpetuating a work commenced long before his time by Gilbert White, of Selborne. The speaker then reviewed the progress which had been made in the subject before them by Dr. Roberts, and by various savants in Germany and France, referring particularly to the works of eminent writers in those countries, and dealing with the action of the German and French governments with regard to meteorological observations. He entered into the details of the formation of maps by eminent meteorologists and climatologists, and with respect to the observations made on the blossoming of plants stated that, as regarded the education of youth, and the enlistment of the future generation, a good work was being carried on at Marlborough College, where the pupils had formed a museum of the plants obtained at different elevations, and Mr. Preston, who had been referred to in the paper, had made observations upon the collections thus formed. The speaker then dwelt upon subjects of accumulated temperatures and of rainfalls presented in the tables, and stated his own impressions upon the various *data* thus given.

Mr. Clark (York) said that observations made upon 31 flowers at 15 to 20 stations, largely by scholars at various schools, had now

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* For some beautiful maps of this kind see *Etude sur la Marche des Phénomènes de la Végétation en France*, by M. A. Angot. Bureau Cent. Mét. de France. Annales 1882.

SCHEDULE FOR DETERMINING LOCAL CLIMATES BY PHENOLOGICAL OBSERVATION.

N.B.—The observations included in the list were made at Marlborough, long: 1° 43′, *lat.* 51° 25′, *elevation above sea,* 400–500 *feet. Soil ; downs, arable, and forest, on chalk.* 50 *miles from the sea.*

NOTE.—In addition to observing the phases of vegetation of the following trees and plants, it is desirable that observation should be made on the max. and min. temperature in the shade, from which the mean temp. and the accumulated temperatures can be calculated. The rainfall, and number of rainy days should be recorded. The elevation above the sea, lat. & long. must be stated.	Habitat. The trees and plants should be growing under natural conditions, and not sheltered by houses, walls, or other trees. The same trees should be observed from year to year. Note soil & subsoil.	Date of blossoming at Marlborough, average of 20yrs, 1861-84. Doubtful obs. in England.	The figures represent the temperature and moisture equivalents of the blossoming of each plant. Accum. Temp.	Accum. Rainfall.	Blossoming. First blossoms open at various places.	Leafing. First leaf - surface visible.	Fruiting. First fruit ripe, seeds brown.	Leaves changing. Half the leaves changed in colour.	Leaves falling. Half the leaves fallen.	REMARKS.
Hazel-nut Tree .... Corylus Avellana (Catkin)	Hedge-rows	I 31	58·4	3·56						
Almond .... Amygdalus communis ...	Shrubberies	III 17 ?	181·5	7·46						
Blackthorn, or Sloe ... Prunus spinosa	Hedges, Commons	IV 1	236·7	8·46						
Pear, common choke .. Pyrus communis	Orchards only	IV 2 ?	242·1	8·53						
Red Currant .... Ribes rubrum	Open Gardens	IV 9	286·4	9·07						
Wild Cherry, or Gean. Prunus avium..............	Woods, open spaces ...	IV 18	350·5	9·75						
Birch Tree .... Betula alba (Catkin)......	„ „ „ ...	IV 21 ?	374·1	9·98						
Broom .... Sorothamnus (Spartium) Scoparium	Commons	IV 30	449·0	10·66						
Crab-apple .... Pyrus Malus	Hedge-rows	V 5	487·8	11·00						
Lilac .... Syringa vulgaris...........	Shrubberies	V 5								
Horse-chestnut .... Æsculus Hippecastanum	Parks, single trees	V 6	497·8	11·07						
Oak .... Quercus Rober (Catkin) .	„ „ „ ...	V 13	563·9	11·56						
Hawthorn, "May" ... Cratægus Oxyacantha ...	Hedge-rows	V 13								
Laburnum .... Cytisus Laburnum.........	Shrubberies	V 14	574·2	11·62						
Mountain Ash, Rowan Pyrus (Sorbus) aucuparia	Shrubberies, Commons .	V 14								
Rye, winter .... Secale cereale hibernum	Cultivated	V 15	584·3	11·68						
Deadly Nightshade ... Atropa Belladonna	Hedge-rows	V 19	626·7	11·96						
Elder .... Sambucus nigra	„ „	V 27	722·0	12·50						
Raspberry .... Rubus idæus	Open Gardens, Commons	VI 1	784·8	12·85						
Snowberry .... Symphoricarpos racemosa	Shrubberies	VI 2 ?	798·5	12·94						
Dogwood, or Cornel ... Cornus sanguinea	Hedge-rows	VI 11	919·4	13·67						
Privet .... Ligustrum vulgare	Shrubberies, Hedges ...	VI 20	1054·0	14·14						
White Garden Lily ... Lilium candidum	Shrubbery Garden	VII 5 ?	1306·5	15·70						
Lime Tree .... Tilia europæa	Parks, open spaces	VII 9	1375·4	16·07						

for ten years been tabulated in the *Natural History Journal.* The observation asked for was that of the first flower showing stamens.

Surgeon-Major Black (Edinburgh) expressed his doubts as to whether there was any connection between the deterioration of plant life and the condition of human health. He declared his opinion that an atmosphere which would not grow vegetation was not inimical to health, and pointed out that in some parts of Lancashire, which grew very good men, the atmosphere was so poisoned by the emanations from factories that trees would not grow.

Surgeon-Major Pringle (London) considered that the climate was often indicated by the changes in the character of the vegetation, and detailed, from his experience in India, the difference in the character of the same plants in different altitudes in the Himalayas, stating that while some plants under certain conditions flourished, under others they were dwarfed, and in some, while the roots lived above ground the plant appeared scarcely to be alive.

Dr. Charles Roberts (London) made a short reply, in the course of which he stated that he was still continuing in his observations.

Thanks were voted to the reader.

On "The Filtration of Water for Town Supply," by Percy F. Frankland, Ph.D., B.Sc.Lond., F.C.S., F.I.C., Associate of the Royal School of Mines.

The filtration of water on the large scale which has now been carried out in London and other places for so many years past, has resulted in much valuable experience being collected by the engineers to whom this process has been entrusted. In this work of improving the methods of filtration, engineers have, however, been but little assisted by science, and have been guided almost entirely by empiricism. It is true that from time to time the subject of filtration has been investigated by chemists with a view of ascertaining the value of this process in removing the organic matters present in water, but these enquiries have resulted in little of practical value beyond demonstrating that in the process of sand-filtration it is only new sand which effects

any noticeable reduction in the dissolved organic matter present. Engineers have, however, not modified their practice in consequence of this information, inasmuch as they are aware that old sand as well as new will produce water clear to the eye, and the removal of at best a small proportion of organic matter has not, in their opinion, justified the additional expense which a frequent renewal of sand would entail.

Briefly, therefore, the object of the water engineer has been to obtain for each acre of filter-bed as large a volume of water which is clear to the eye, regarding the organic matter in the water as a factor which is beyond his control, and which can only be modified by changing the source of supply.

Sand-filtration has, therefore, not unnaturally been held in little repute by chemists, who fail to recognize, as of any sanitary importance, a process which has no material influence upon the dissolved organic impurities of water.

For many years past we have, of course, been fully alive to the fact that the real danger in sewage contaminated water, does not reside in the organic matter discoverable by chemical analysis, but in the presence of minute living organisms capable of producing zymotic disease. But until the last five years very little was known either of these organisms themselves or of the manner in which they would deport themselves under the various processes of purification to which water is subjected. It is to the beautiful methods of bacteriological investigation, which we largely owe to the genius of Robert Koch, that is due the great advance which has recently been made in our knowledge of the sanitary conditions of water-supply, and more especially of water purification. Indeed it is difficult to overestimate the stimulus which has been given to this important branch of science, by the introduction of these novel methods of investigation.

By the light of researches on the bacteriology of water made with the assistance of these methods, the process of filtration assumes an altogether new aspect, as its efficiency can now be gauged by another standard besides the naked eye of the engineer or the organic analysis of the chemist. A standard, moreover, which is far more closely connected than are either of the others with the sanitary aspects of the question.

By means of the methods of Koch, which I have described elsewhere,* it is possible to determine, with very considerable quantitative accuracy, the number of micro-organisms in a given volume of water, so that, by submitting the water-supply of a town to this examination before and after filtration, or,

* Proceedings, Royal Society, 1885. Journal, Society of Chemical Industry, 1885.

indeed, before and after any other form of purification, we ascertain whether and to what extent the filtration or other process of purification in question has been effective in removing the micro-organisms from the water.

Now, although the organisms thus removed are probably in general perfectly harmless, it must not be supposed that their removal is of no importance, for it must be remembered that the micro-organisms which are known to produce disease, and which are termed "*pathogenic*," do not in any way differ from the ordinary organisms in water so as to render it probable that they would behave differently in the process of filtration; but, on the contrary, there cannot be any serious doubt that their behaviour under these circumstances would be precisely similar. Now, such disease-organisms frequently do gain access to water, and it is obviously of the greatest importance to ascertain what sort of impediment this process of filtration, which is so largely practised, offers to their passing on to the consumer.

By means of this bacteriological examination, it is thus possible to obtain a far more satisfactory knowledge of the kind of filtration which water has undergone than by a mere appeal to the eye of the observer, and the vague terms "turbid," "slightly turbid," "clear," and the like, which have hitherto been employed to describe whether the filtration of water has been satisfactory or not, must now be replaced by this scientific and important standard which I have described.

The value of this standard has been duly recognised by Col. Sir Francis Bolton, the Official Examiner under the Metropolis Water Act, and for nearly two years past I have now periodically submitted the London Waters to this test, and during the past twelve months these results have been published by the Local Government Board.

These periodical examinations, on the one hand, of the river waters from which the water-supply of the Metropolis is mainly derived, and, on the other hand, of the water after filtration, as supplied to the consumer, have fully established the extraordinary power which this simple process of sand filtration possesses of removing micro-organisms from water. In the following Table I have recorded the averages of the reduction in the number of micro-organisms, obtained during the first six months of the present year, in the water drawn from the rivers Thames and Lea respectively:—

Reduction in the Number of Micro-organisms present in the River Waters supplied to London.

1886.	River Thames. Chelsea, W. Middlesex, Southwark, Gr. Junction, and Lambeth Co.'s.		River Lea. East London Company.
January	95·6 per cent.	....	99·4 per cent.
February	98·6 ,,	....	98·8 ,,
March	95·3 ,,	....	94·1 ,,
April..........	99·1 ,,	....	96·3 ,,
May	98·8 ,,	....	95·2 ,,
June	98·9 ,,	....	90·5 ,,
Average for 6 *Months*,	97·7 ,,	....	95·7 ,,

These figures give a definite picture of the efficiency of the treatment as regards the micro-organisms present in the waters.

In the following Table are recorded the figures from which the above averages are obtained, viz., the number of microbes found in one cubic centimetre of the unfiltered river waters, on the one hand, and, on the other hand, the number of microbes found in one cubic centimetre of the waters supplied by each of the Metropolitan Water Companies, drawing from these sources:—

Number of Micro-organisms contained in 1 *cubic centimetre of London Water.*—1886.

	Jan.	Feb.	March.	April.	May.	June.
Thames.						
Unfiltered Thames water at Hampton	45,400	15,800	11,415	12,250	4,800	8,300
Chelsea..	159	305	299	94	59	60
West Middlesex ..	180	80	175	47	19	145
Southwark	2,270	284	1,562	77	29	94
Grand Junction ..	4,894	208	379	115	51	17
Lambeth	2,587	265	287	209	136	129
Lea.						
Unfiltered Lea water from intake of East London Co.	39,300	20,600	9,025	7,300	2,950	4,700
New River	363	74	95	60	22	53
East London.. ..	224	252	533	269	143	445

A glance at this latter Table shows that there is a certain uniformity in the position which the various companies occupy as regards freedom from micro-organisms, and, as I shall presently show, there is an unmistakable relationship between this position of each company and certain factors in its mode of working, which theoretical considerations lead us to anticipate should affect the results.

The factors, which in my opinion, are more especially calculated to influence the number of microbes present in the distributed water are the following :—

1. Storage capacity for unfiltered water.
2. Thickness of fine sand used in filtration.
3. Rate of filtration.
4. Renewal of filter-beds.

1. *Influence of Storage Capacity for Unfiltered Water.*—Firstly through greater storage capacity, the necessity of drawing the worst water from the river is avoided, a matter which in the case of a stream like the Thames, liable to frequent floods, is of great importance. Again, during the period of storage, subsidence takes place, the water depositing the greater part of its suspended matter, along with which a large proportion of the micro-organisms will also go to the bottom. Then a further diminution takes place through degeneration and decay of the microbes, for as I have recently shown* the number of micro-organisms in the unfiltered river-waters diminishes on keeping irrespectively of subsidence, probably owing to the competition between different forms hostile to each other, as well as by the production of chemical compounds inimical to their further multiplication.

2. *Influence of Thickness of Fine Sand.*—That the thickness of the filtering stratum should exercise an important influence on the number of micro-organisms passing through the filter must be sufficiently obvious. In estimating the thickness of such a sand filter the fine sand only should be taken into consideration, as it is only this portion of the filter which can have any effect in the removal of microbes.

3. *Influence of Rate of Filtration.*—That the filtration is the more perfect the slower the rate, is sufficiently well known to all who have studied the subject of filtration either on the small or the large scale.

4. *Influence of Renewal of Filter-beds.*—In my experiments†

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* Proceedings, Royal Society, June, 1886.

† Water Purification, its Biological and Chemical Basis. Proceedings Inst. of Civil Engineers, April, 1886.

on filtration in the laboratory I found that even the most perfect filtering media sooner or later lose their power of retaining microbes, and hence the importance of frequent renewal must be apparent.

In considering how the differences in these various factors, which the statistics of the London Water companies exhibit, may be expected to influence the results obtained in the removal of micro-organisms, attention must be restricted to the five companies drawing water from the Thames, as it is only these which have practically the same raw material to deal with, for the amount of organic life in the river Lea at the intake of the East London Company is often very different from that in the Thames at Hampton, and the difference in the case of the intake of the New River Company is doubtless even still greater, besides the problem being there complicated by the admixture of a very considerable proportion of deep well water.

The close proximity of the intakes of the five Thames companies, however, furnishes a peculiarly favourable opportunity for instituting such a comparison.

The factors in the mode of working, which have been pointed out above as of special importance in exercising an influence upon the result obtained, are given in the following Table, the figures being taken from the statistical Table given in Sir F. Bolton's "London Water Supply," published in 1884 in connection with the Health Exhibition at South Kensington.

More Important Factors in Mode of Treatment by Thames Water Companies.

Name of Company.	Average Daily Supply in Millions of Gallons.	Available Storage Capacity in Millions of Gallons.	Average Storage in Days (Calculated).	Rate of Filtration per Square Foot in Gallons per Hour.	Thickness of Fine Sand.	Renewal of Filter-beds (calculated).
						Proportion of total acreage cleaned per Month.
Chelsea	9·5	140·0	14·7	1·75	4ft. 6in.	0·59
West Middlesex ..	12·8	117·5	9·2	1·5	3ft. 3in.	0·90
Southwark	19·9	66·0	3·3	1·5	3ft. 0in.	0·90
Grand Junction ..	14·1	64·5	4·6	1·75	2ft. 6in.	0·81
Lambeth	14·2	128·0	9·0	2·0	3ft. 0in.	0·50

By means of this Table the five Companies may now be

classified with respect to each of the four factors in question, thus :—

Company.	Storage Capacity.	Thickness of Fine Sand.	Rate of Filtration.	Renewal of Filter-beds.
Chelsea	1	1	3	4
West Middlesex	2	2	1	1
Southwark	5	3	1	1
Grand Junction	4	5	3	3
Lambeth	3	3	5	5

From this the general order of merit, as regards these factors, can be deduced, by taking the average position of each Company, thus :—

Company.	Average Position.		Order of Merit.
Chelsea	2·25	....	2
West Middlesex	1·5	....	1
Southwark	2·5	....	3
Grand Junction	3·75	....	4
Lambeth	4·0	....	5

From the theoretical considerations here instituted, it would be anticipated, therefore, that dealing with the same raw material the West Middlesex Company should, on the whole, obtain the best average as regards the removal of micro-organisms, and that the results obtained by the other four companies would follow in the order of Chelsea, Southwark Grand Junction, and Lambeth.

In the following Table the actual position, as regards freedom from micro-organisms, of each company is recorded for each of the first six months of the present year :—

Company.	Chelsea.	West Middlesex.	Southwark.	Grand Junction.	Lambeth.
1886.					
January	1	2	3	5	4
February	5	1	4	2	3
March	3	1	5	4	2
April	3	1	2	4	5
May	4	1	2	3	5
June	2	5	3	1	4
Average..........	3	1·8	3·2	3·2	3·8

Arranging the companies according to these averages, the following series is obtained.

West Middlesex	1
Chelsea	2
Southwark	3
Grand Junction	3
Lambeth	5

This series it will be seen is all but identical with that which was indicated above by theoretical considerations.

This remarkably close coincidence between theory and practice clearly shows that filtration is no longer a process which should be guided by empirical rules, but that this most important function of filtration—the removal of micro-organisms—is dependent upon principles with which we are already intimately acquainted, and which are largely under our control.

When it is remembered that the results of filtration quoted above have been obtained by engineers working quite independently of any theoretical considerations of the kind to which I have here referred, we may surely look forward with confidence to even still more successful and uniform results when practice is assisted by this novel departure of sanitary science.

Some few observations were made by Dr. Hill (Birmingham), Dr. Tempest Anderson (York), and by M. Platnauer (York), with respect to microbes being found in filtered water.

Mr. Rymer (York) asked some questions in relation to filtration substances. He pointed out the differences between some of the sands, and dealt generally with the question of the filtration of the water supplied to the inhabitants of York, where river sand is very largely used.

Mr. Clark also spoke on the same question.

Professor Hope (York) asked those who visited the water-works to take particular notice of the excellent contrivances which were there utilized for washing and purifying the filtering sands.

Mr. W. Whitaker (The Chairman) said that the great interest in this paper had been displayed by the various questions asked of Dr. Frankland. His opinion was that for the purpose of filtration it was necessary to have as clean, even-grained sand as it was possible to obtain.

Dr. Percy Frankland (London), in referring to the subject of the

organisms in water, remarked that he had found that very rapid multiplication of the microbes took place in the storage of filtered water; the increase proceeding up to a certain point, after which the number again diminished. In deep well water he had found this multiplication to be even still more rapid and pronounced, whilst in unfiltered river water he had not observed any such multiplication on storage, but, on the contrary, a continuous decrease. He believed these differences to be due to the fact that in the unfiltered river water there were a number of different varieties of organisms, many of which were probably hostile to each other. In the filtered river water the number of different varieties besides the absolute number of organisms was very much smaller, and hence the struggle for existence was less intense, and multiplication could proceed until an equilibrium between the different individuals was reached, whilst in the deep well water the number of organisms, as well as the number of different varieties, was even still smaller, and hence the struggle for existence was less severe even than in the filtered river water, and consequently the multiplication of the few organisms present still more rapid. Experiments which he had made on the duration of life of pathogenic organisms in water, had shown that although some varieties, such as the "comma bacilli" of cholera, could be preserved in water for a number of days, no multiplication took place, but on the contrary, a more or less rapid diminution in their number was observed. In sewage, however, he had found they flourished and multiplied abundantly.

On "The Sanitary Condition of the Country, with special reference to Water-channels," by ROBERT T. COOPER, M.A., M.D.

SOME explanation is needed as to the title we have chosen for this paper. Coming before an assembly like the present, at whose meeting almost every question bearing upon the health of the community has from time to time been discussed, it may seem absurd to affirm that the sanitary condition of the country generally is such as ought to arouse to activity the people of this and of every land.

The neglected condition of the channels in which the rainfall of the country should be stored, and through which it should discharge, is intimately connected with the health and well-being of the community, and this, I venture to assert, constitutes a fitting theme of discussion for a Sanitary Congress.

Sanitary authorities have in late years expended much time upon, and given much thought to, the consideration of the best

methods to be adopted for effecting the removal of refuse material from dwelling houses and towns.

They have also discussed at some length the ever recurring and increasingly important question, among all manufacturing communities, of the pollution of rivers.

My object in coming forward is not of course to refer to the condition of dwelling houses and cities, nor even to discuss the subject of river pollution as this is generally understood, but rather to insist upon the necessity, urgent and imperative as it is, of directing the attention of the members present, and through them of our parliamentary representatives, to the generally defective condition, and not merely the pollution, of the streams and rivers of the country.

In a lecture I delivered at the Balloon Society, on Friday evening, 16th July, 1886, on *Our Empire of Rivers*, I entered somewhat largely into this subject. But my intention now is to direct attention to the great importance of our rivers as channels for the storage of pure and unpolluted water, and the necessity, from a hygienic point of view, of adopting measures to secure a sufficient, gentle and continuous flow of water through them.

This is a question of grave importance not alone to England; it demands, very urgently, the consideration of the inhabitants of every part of the civilized world.

Gradually but certainly populations increase; and, impelled as well by ambition as by necessity, men are at the present day driven to select a city rather than a country life.

The consequences of this to the country are that it is neglected, and less money is being expended upon it, and less consideration paid to its sanitary and agricultural condition than would otherwise be the case.

Sanitary science, represented as it is by this august assembly, has done a great deal towards rendering city life more healthy, and in every way more endurable; the time has now come when the attention of the entire community must be directed to the sanitation of the country districts. This is a matter that involves the life and death of individuals, the existence of our cities, the continuance and progressiveness of our race, and the welfare of all mankind. The resident population of England, Scotland and Wales, has increased from about 11,000,000 in the beginning of the century, to about 35,000,000 at the present moment. One necessary and obvious result of this is that a much larger amount of material has been loosened from its surroundings and sent adrift, and this has proportionately added to the silt in our rivers.

This being the case, it is evident that it is more than ever incumbent upon us to adopt measures that are calculated to

keep these channels freely flowing and their contents in a natural and pure condition.

It is a fact beyond dispute that our rivers, and the tributaries and sub-tributaries of our rivers, are silting up very rapidly; and indeed the only possible inference is that accumulations are being thrown down in a proportionately greater quantity than when we had a less population.

If then this be the case—and a mere "walk over" our fields will convince the most sceptical, by the very tangible evidence of the beds of dried-up streams, of the urgency of the situation, and, inferentially, of the danger that exists to the health, well-being, and safety of the community, the situation is the gravest —it admits of no delay.

The agricultural poverty of this country will most assuredly and most unmistakably intensify the present disastrous condition of our streams; it will be followed by the most calamitous consequences, if Government refuses to take in hand the supervision of the water-ways, and the proper foresting of the country.

Our imperative duty is to warn the Government and people of England of the fatal results which inevitably ensue from a continued neglect of water-channels, and of the need there is of an immediate outlay of national funds in the interests of the land and of the people of the country.

It cannot be too often or too perseveringly impressed upon the notice of the public, that if the smaller streams throughout the country are allowed to silt up and become inoperative during times of drought, the effect will be the desiccation of the soil and consequent loss of fertility, and the lessening or even complete exhaustion of the water coursing through the rivers themselves.

Such absence of thought is displayed upon this subject, that a person to whom I communicated this neglected state of our rivers, very innocently observed how desirable it was to take measures to secure the efficiency of our larger water courses, and leave alone the smaller ones, so as to have the cities well supplied with water. It did not seem to occur to my friend, as it does not to many, that it is impossible to have large rivers unless we possess and pay attention to the succession of small streams by which these should be perennially supplied.

The tendency of all badly supervised water channels, especially of those that course through soft argillaceous and arenaceous strata, in countries and portions of country having no protection for their uplands, is to silt up. And the beds of rivers and streams being in this way raised, their efficiency for the purpose of natural water storage is dangerously diminished.

Hence it comes that not alone do our rivers fail to afford adequate moisture to the adjacent fields in the dry seasons, but when

rain falls the country becomes flooded, and loss of life and destruction of property result. So that in fact that which ought to bring prosperity to the agriculturist, and increased and sustained fertility to the soil, is attended with destructive and injurious results, owing to the insufficient capacity of the water storage channels of the country.

And then the land becoming water-logged, inferior vegetation springs up, and owing to this too extensive evaporization fogs prevail; and the heat of the sun, expended upon the vaporization of the extended, watered areas, is thus hindered from exerting its full influence upon the soil. This, as we know, is one of the most fruitful causes of malaria, and the prevalence of fog leads to the deterioration of the vital activity, both of the cattle grazing upon the fields and of the inhabitants of the adjoining districts.

And besides all this, a country thus uncared for furnishes a fungus-growing surface, upon which the germs of infective diseases increase and multiply. Hence it is evident that the creation and preservation of a perennial supply to the water channels of the country is necessary to the maintenance of the healthy activity of human life, and indeed of all forms of animal and vegetable existence.

This being the case, it behoves us to consider very earnestly what steps ought to be taken to effect a consummation so devoutly to be wished as the restoration and conservancy of the natural storage channels of the country, and the strict protection of their catchment areas.

In the first place it will be necessary to seek, nay to demand, governmental aid in the accomplishment of this purpose. A Woods, Forests, and Rivers Preservation Department for the United Kingdom should be instituted, and an Act passed having for its object the governmental direction of the country generally, and the imposition of powers over owners of land to compel them to reforest hills and uplands being the sources of streams and rivers, and to replant river banks, and do other things necessary to the maintenance of the natural storage and sufficient supply of flowing water throughout the country.

The streams and river channels of the country, the aggregate length of which in England and Wales alone amounts to, roughly, 200,000 miles, are, as we said, silting up very rapidly.

The work of restoring the natural beds to all the lengths of rivers and streams of the country will of course be a very considerable undertaking, and will require much time for its accomplishment, as well as a colossal expenditure of capital. As a set-off against this, however, we may safely affirm that it will be in every way remunerative, and will promote the health

and happiness of the present generation, and of generations to come, while it will distribute wealth throughout the country, and lessen, if not altogether neutralize, the undesirable ardour of the working classes to flock into and crowd the towns.

The silt, as the accumulated material upon the beds of rivers is called, can be turned to very useful account. Formed, as it is, by the washings from the fields and uplands of the catchment areas of the rivers, and becoming intermixed on its passage to the rivers and streams with decaying vegetable refuse, it will obviously constitute a splendid top-dressing for meadows, pasturage and other agricultural lands; much of it may be utilized for pottery and brick making, while a large portion of that accumulated in the more rapid and hilly streams will be suitable, without preparation, for macadamizing roads.

But it is not enough to free our river channels of deposited material. We must take measures calculated to maintain the bed of the river, when restored to its natural condition, in an unimpeded, cleanly, and unhindered state. This is to be effected chiefly through the agency of *trees* and underwood. The importance of trees as sanitary agents in this connection can hardly be over-rated. We cannot dissever the tree from the river, the one supplements the other; and the tree is as necessary to the existence of pure flowing water as are the springs and affluents, by the unaided action of which the river is very generally, but I need not say very erroneously, supposed to be maintained.

The stream, let us therefore insist, cannot exist and its flow be maintained in a natural condition, nor can it be depended upon as a source of supply of pure water in dry as well as wet weathers, without a proper distribution throughout the country of trees.

This is an axiom with all who have carefully and thoughtfully considered this matter, and it ought to be impressed upon all dwellers in the country, as well as upon those—indirectly but vitally interested—whose occupations betake them to the cities.

The votaries of religions antecedent to Christianity were jealously careful to preserve large vegetation upon the uplands of their countries.

The Druids in this country kept the hills well forested; and in India the Brahmins left their forests intact at the sources of their rivers and streams, and here they built temples in honour of their gods, and here they worshipped according to their lights. The great Israelitish law-giver, Moses, was equally solicitous about trees, and philosophically and realistically declared to his people that "*the tree of the field is man's life.*" And man's life it may well be said to be; for we invariably find that man thrives

and prospers most in those regions, and in those alone, that are well wooded. It is not sufficiently considered that large districts of Africa, Asia Minor, and other desert regions, require only a well supervised system of *reboisement* to render the country as habitable and as healthy as any part of the globe. The effect of preserving vegetation upon uplands that constitute the partings between the catchment basins of rivers, is that the rain, when it falls, instead of running off at once and forming temporary and transient and injuriously rapid streams, lingers in the foliage, and continues to be a source of gradual and continuous supply for days, and even weeks, to the neighbouring streams.

And rain water is still further held in check by the roots of grasses, bushes and trees, with the effect that it gradually filtrates through the sub-soil, and traversing a downward course, in time finds its way into the stream, after having moistened the intervening soil and helped to supply the needs of the vegetation in its path.

And besides, the extensive leafy surface favours evaporation, and thus keeps up a natural atmospheric moisture, which contributes to the descent of rain, when clouds, blocked in their passage by high vegetation, linger upon the hills.

Then the fall of leaves and seeds and seed pericarps, and decayed blossoms and branchlets of the trees, will in course of time supply the place of the humus washed down by rains from hills that have been denuded. Thus the hilly countries, which by our neglect, our christian neglect, are in many parts of England, but more a great deal in India, rendered waste and unfertile, can, by the natural operation of trees, be restored to their pristine condition of fertility, by the acquisition of a fresh and well-manured soil.

The holding-back influence of trees before alluded to upon rain water, must necessarily afford a suitable opportunity for the underground absorbent strata to become saturated, and hence they constitute an indirect origin of springs. Indeed one of the commonest sights in the country is the beds of dried up springs, where woods have been extensively felled, and the ground cleared of trees and underwood. It is evident, therefore, that if we wish to have a continuous and sufficient flow of water in our river channels, and to lessen the causes contributing to overflow or flooding, we must create and secure a surface capable of retaining rain water in our hills and uplands; and this object is best secured by the agency of trees and forests, and luxuriant herbage.

It is obvious also from what we have stated, that not alone will the rain be better retained, but its fall will be greatest upon the hilly portions of the country that are under forest. Forests also prevent the accumulation of silt in rivers, for they keep back the

earth and sand and stones, that would otherwise be washed down from the hills into the water channels.

It is necessary for the conservation of our rivers that trees should be planted, not alone upon the hills but along the river banks. Here, by their roots, they not only increase the height of, but give firmness and cohesion to the banks; prevent the washing in from the river-sides and neighbouring gentle uplands of clay and sand; and by the promotion of the porosity of the soil through the agency of their roots, the good effect upon the adjoining lands of the lateral pressure of the river water inland is secured, thus giving a continued supply to the sub-soil moisture, necessary for the nourishment of grain crops and other forms of vegetation.

More than in any other country, the rivers of England discharge their waters into large estuaries of the Ocean—the Thames, the Severn, the Mersey, and, in Scotland, the Clyde, are examples of this. Upon these estuaries the silted condition of all our rivers is at the present moment exerting what might appear to be a paradoxical influence. The estuaries are becoming less capacious in depth but more extensive in area; and this not so much in consequence of the agency of ocean water as from the lessened activity of our inland water streams. The volume of water in our rivers no longer forms a barrier to the entrance of tidal waters up their channels, and consequently the area over which the salt water washes is laterally and longitudinally increasing; while the increased amount of river silt, washed down by conjoint agency of river and ebbing tidal water; and the ocean sands, increased by the additional influx of salt water, are contributing rapidly to the filling up of estuaries imperatively required for the maintenance of our commercial prosperity.

Bars are forming at the mouth of most of the rivers of England, as for example, the Thames and Severn, and the Humber, &c. The enormous loss the country will sustain should means not be adopted for counteracting this is simply incalculable; our stability as a nation, and the very lives of our inhabitants, will be jeopardised by the continued and utterly indefensible neglect of the water ways of the country.

The effect of an inrush of salt water along channels that ought to be filled with pure, clear, fresh, and normal river water, is obviously in every way destructive to vegetation, and not in accordance with the requirements of the neighbouring cities and towns, and cultivable lands.

We have pointed out the absolute necessity that exists for taking into serious and immediate consideration the rapid deterioration our rivers are undergoing, and have expressed the conviction that the maintenance of the prosperity of the

country is dependent upon the control exercised by Government over our fresh-water channels, and the directions given and insisted upon for maintaining a sufficiency and proper distribution of trees and brushwood and forest.

The methods suggested are the natural ones, and would be amply sufficient; nevertheless I find that these proposals meet with considerable opposition.

The opposition to them comes from men who are extremely active in advocating the construction of a succession of locks across rivers, and the elevation of the natural river banks by earth or other artificial embankments.

The effect of locks is to obstruct the natural flow of the rivers, and to create inundations. They lessen the "working" capabilities of the river; hence, the natural current being stayed, an opportunity is given for the silt to deposit. By the construction of locks we simply convert a channel that is intended by nature to be the storage area of clear fresh and gently but continuously flowing water, into one in which the water is insanitarily stagnant and inferior for the supply of drinking water to man and beast.

Then the banking up of rivers is attended with consequences even more unsatisfactory; for, if we bank up a river without removing the silt, and thus restoring the natural bed, we raise the level of the river itself; and if we do this, obviously the water from the river will percolate through the thin embankments from the river on to the fields, the position of these being thereby rendered more dependent than the river itself; while if, previously to banking, we remove the accumulated silt, it is impossible to conceive what advantage we can gain by elevating the banks, as in most of our rivers the silt occupies three and four times as much space as does the average volume of river water.

We require in this, as in most other things, to imitate nature, and to understand her methods of working; and we must insist upon it that the health and happiness and safety of the community will be imperilled if the rivers of the country are not kept in an efficient and satisfactory condition.

As sanitarians, therefore, it behoves us to warn the Government of this country, and of every country, of the destructive and devastating effects that must surely succeed the continued neglect or improper management of water-channels, and of the happy and comfort-giving consequences of the adoption of a simple, intelligent, and plainly evident policy, having for its object the clearing out of a country's water-ways.

Mr. Baldwin Latham, M.Inst.C.E. (London), remarked that he could not endorse the statement made as to the influence of trees upon the river. There was no doubt some connection between the rivers, rainfall, and the trees. He had for some years been making observations upon the temperatures of trees, and the conclusion he had arrived at was that trees had no influence in producing rain. If trees were planted upon the hills the trees increased the altitude, and the higher the hills the greater was the amount of rainfall; and it was certainly in this manner that trees influenced the rainfall. Then there was another thing to be said of trees—that they were colder in summer and warmer in winter than the surrounding atmosphere; and these changes or differences which occurred in the atmosphere influenced the rainfall, and tended to increase the rain, when the other conditions were favourable to it. Dr. Cooper had referred to trees as purifying the river. Had Dr. Cooper ever noticed that trees which stood on the banks of a river dropped their leaves into it, and that thus the leaves became a decaying and putrifying mass of vegetable matter, and by their decomposition produced impurity in the water? With respect to the carbonic acid question, he remarked that the largest amount of carbonic acid in the air was present when lands were uncultivated and at the highest altitudes, and its influence was felt in the rainfall in dissolving the hills, and bringing down the material from the high parts of the earth into the rivers. The evils of navigation on adjoining lands were more than compensated for by the increased value of the land arising from improved means of access.

Mr. G. J. Symons, F.R.S. (London), said he was rather disappointed with the paper, and considered that its title was its best part. They had before them the condition of the Yorkshire and Lancashire rivers, which were in a terrible state as far as the river channels were concerned. Dr. Cooper did not say one word about these things, nor did he dwell upon the fouling of streams by the population living upon their banks. Something more than mere Acts of Parliament was wanted to get our rivers into anything like a satisfactory condition, and that was the influencing of the whole population. With respect to the questions of trees and rainfalls, the speaker recommended them to study the book of Mr. Marsh, where he entered upon the whole subject.

Dr. Percy Frankland (London) stated that the atmosphere at high altitudes was remarkably rich in carbonic acid, owing to the absence of vegetation. Thus the proportion of carbonic acid present in the air at the summit of Mont Blanc had been found to be as great as that in the air of London, both being markedly in excess of that in ordinary country air.

On "The Collection and Storage of Rain and Drinking Water, with a description of a system for carrying out the same," by Surgeon-Major R. PRINGLE, M.D.

WITH the marked attention lately drawn to the sources of the water supply for urban and rural districts, and the best mode of collecting this supply, the subject of the storage of the drinking water portion of it, whether as obtained from waterworks adopting Artesian wells as their sources, or collecting and filtering the rainfall over given areas, is one that must, in the not very distant future, engage the serious attention of the authorities; for, though the aim of all modern sanitary measures appears to be to secure what is termed a "constant supply," yet there are some localities where from various causes this constant supply is not practicable, and others where, though practicable, it is not a wise measure on which to be entirely dependent, because it is possible that, in an emergency like the following, defectively stored water may be had recourse to for drinking purposes, and that among young men hard at work, and probably partaken of when exhausted, and the system peculiarly susceptible to typhoidal poisoning of a most fatal type. The instance I allude to was as follows: having occasion to visit a large establishment in the South Eastern circle, employing upwards of one hundred men, I asked what arrangements had been made for drinking water when the constant supply was cut off, owing to the bursting of a large pipe, and was informed that the water stored in the cisterns for sanitary purposes had been used on that occasion for drinking water!

I am well aware that the great objection to cisterns of any kind, in relation to the reception or storage of drinking water, is the difficulty of keeping them clean, and it would appear that on this account all attempts to improve the present system of cisterns, with a view of increasing and maintaining the purity of the water they contain, have been abandoned. In proof of this, in the International Health Exhibition of 1884, there was not, excepting my own, one single cistern (unconnected with filtration, which mode of purification mine never undertook) designed with the aim of securing the above requirements, and I therefore only obtained a silver medal for mine because there was no competition. Such being the case it is not unnatural that the attention of all sanitarians has been centred on the *constant supply* as the one and only way of getting rid of

that which *seems* to be not only very defective but *apparently* incapable of improvement.

Water drawn from Artesian wells, such as those sunk by the Kent Water Company, might possibly be used by the constant supply delivery for drinking purposes, if there were no filtering beds, without the intervention of any cistern to act, not as a filtering, but settling chamber, but this can hardly be advanced in favour of all the water supplies for London, some of which, instead of pumping their water, as the Kent Company do, from nature's unpollutable and inexhaustible subterranean reservoirs, merely collect the rain-fall drawn from a given open surface, or the same as supplied in a gathered form, by means of a stream or river occasionally themselves of questionable purity; in all these latter water supplies, whether served out in what is termed a "constant supply," *i.e.*, a supply always available after passage through a registering meter, or "intermittent supply," *i.e.*, a supply daily admitted into the storage cisterns for a fixed time each day, a settling chamber would be a great desideratum; but no cistern or tank, into which the water is admitted by a ball valve cock *from the top*, can ever be a settling chamber; yet I hope to be able to show that the principle I advocate, by means of the addition of the "sursum" automatic water purifier to the present water fittings in the ordinary cistern, or tank, as shown in the patterns now exhibited, can supply this at an outlay within the reach of all, and thus convert cisterns and tanks in present use into settling and storing chambers, applicable either for the constant or intermittent supply.

The action of this settling chamber, in the case of the water supplied by the Metropolitan, and all other Water Companies whose supply is gathered from surface rain-fall, either directly from selected watersheds, or indirectly from streams or rivers, and then, after filtration, is distributed for drinking purposes, would only be such as would admit of any impurities, unarrested in the filtering beds, or generated in the mains by "dead ends," and then forced through the service pipes into the household cisterns, or storage tanks, being enabled to rest on the "tranquil bed," on the floor of the cistern or tank.

Once here, these impurities could not pass into the body of water in the cistern, and thus into the drinking water supply of the household, either by the constant disturbance of the constant supply, or that caused by the daily admission of an intermittent service further from this tranquil bed, by the simple process exhibited in the model now shown, which was in the International Health Exhibition, London, 1884; these impurities can be removed without interfering with either service.

As regards the collection of the rain-water from the roofs, some such settling chamber seems to be almost an absolute necessity, for, though a filtering chamber is frequently attached to many underground storage tanks for rain-water, yet the impurities met with in this water, such as soot, &c., owing to the manner in which the rain-water is admitted into these tanks, cannot, by any present system of filtering or settling, be so removed from the point of withdrawing the water as to admit of its being collected in the vicinity of large towns, sufficiently pure or clean to be available for any domestic, and certainly not for drinking purposes.

The water collected from each shower of rain, when admitted into the tank, disturbs that which has begun to settle; and, except when a considerable time has elapsed between the showers, the water collected is but rarely fit for any practical use, and thus, with the increase in houses, and their consequent additional smoke and soot, the collection of rain-water has now been very generally abandoned in the suburbs of large towns, as worth neither the trouble nor the expense. Such was remarked to me when I came to Blackheath upwards of two years ago; but I was satisfied that the principle I had employed for the collection and storage of water from the hill-side streams in the Himalayas many years ago, as the drinking water supply of one of the largest Sanatoria in India, would succeed in the case of rain-water collected from the roofs even on Blackheath, and my expectations have been more than realised. The samples of the rain-water now exhibited were collected by the application of this principle to an ordinary cistern through which the rain-water pipe passed, and the deposit from the "tranquil bed" of this settling chamber, and the substance which floats on the surface will, I think, be conclusive evidence, that a cheap, simple, and efficacious mode of automatically purifying rain-water has been arrived at.

Here I would draw attention to a valuable paper read at the Croydon Congress of this Institute, in October, 1879, by H. Sowerby Wallis, Esq., F.R.Met.Soc., entitled "Rain collected from roofs considered as a domestic water-supply." Mr. Sowerby Wallis in this paper shows the vast importance of this subject in the following instructive sentence, to which I should like to draw marked attention: "We are entirely dependent on rain for our supply of water; for, whether we catch the water which falls on our roofs, or obtain it from shallow or deep wells, or from streams and rivers, it is nothing more or less than rain." Though this was written only seven years ago, yet the subject of water-supply has in that time advanced with strides or rather bounds, which can only be calculated by a reference

to the enormous sale which popular works on the water-supply question, written by such authorities as Sir Francis Bolton and others, have obtained.

Without doubt the International Health Exhibition of 1884, and the conferences then held on the subjects of water-supply and sewage disposal, gave an immense impetus to the study of these most important subjects, illustrating in a marked manner the foresight of Albert the Good in 1851, and holding up to all Europe the inseparable connection between the following, as regards the health, and, indeed, as was proved in the case of Naples and Spain in 1884 and 1885, the wealth of nations, viz., the intimate relation between the health of a city and its water-supply, and the sewage of the same and its disposal.

The more the question of sewage disposal is pressed the more are we driven to the two great sources of water, viz., nature's inexhaustible and unpollutable reservoirs, in this country underground (though in the Himalayas above ground also, as in the glaciers) and the rainfall from roofs. The former was remarkably illustrated at Brighton during the Congress just concluded of the British Medical Association, when, thanks to the kindness of the Water Company, opportunities were granted for a careful study of their most remarkably instructive, indeed, wonderful waterworks, designed and carried to such a state of perfection as to leave nothing to be desired for supplying the wants of that "Queen of Watering-places," under the head of water-supply. The latter, though in certain localities of limited rainfall, neither so equally inexhaustible, nor yet unpollutable, is nevertheless, when viewed as a whole, in these sea-girt islands of the ocean, if collected, very considerable, and if carefully stored, remarkably free from impurities; while the most visible and chief of these impurities, viz., soot, in the settling chamber alluded to is, when automatically washed, made to act as a valuable antiseptic to the whole body of water, and also, when collected from the surface of this water, a marketable commodity with a recognised fixed value, as the basis of a superior black pigment and as a very pure carbon.

The great interest now attaching to the question of the disposal of the sewage, not only of large centres of populations but even of small towns, and the general desire to employ it for good instead of throwing it away to be a source of danger to the public health, or an inexcusable waste of valuable substances, bring into marked prominence the subject of the storage of the great natural source of the water supply, viz., rain; but unless our present knowledge of sewage transformation is greatly improved, it may for the present be found better to waste without injury, than utilize with risk to health. It is idle,

if not criminal, to shut our eyes to the great risk to the public health incurred by even the simplest and most common effort made with the double view of disposing of and utilising this sewage matter—I mean the employment of the contents of the ordinary cesspool in rural districts. The manner in which this is done in some places would undoubtedly account for much of the sickness brought to large centres of population by the milk.

Nor are all of the extensive and costly systems of water-supply for cities with populations of over 100,000 quite free from this risk of danger to health. One instance comes to my memory in which the rainfall over a given area, aided by the dammed-up waters of a hill stream, constitute, after passage through filtering beds, the water supply of a large manufacturing city. On the banks of this stream during its course to this dam are more than one village, the entire surface drainage of which can only be into this stream, while the other sanitary arrangements are not such as to add to the purity of this water.

Again, what kind of manure is thrown over the fields which make up the watershed of this or any similar collecting basin? In short, the more the subject is gone into the more the proper value of rain-water becomes evident. And as there are few cities who can fall back upon a Loch Katrine to supply its wants as Glasgow has, so it becomes all those whose water supply is liable to pollution by any means traceable to this matter of the disposal of sewage, to see to it before an epidemic directly results from that which should never have been originally permitted. I repeat, therefore, the denser the population on the land the more need to go deeper to Nature's reservoirs for the water, or higher for the origin of all, viz., rain. The deeper we go for the water by means of Artesian wells the more we limit the supply in the vicinity near the earth's surface; for an Artesian well, as has been amply proved lately, gradually exhausts the water supply of the little wells above it, until they have to be abandoned altogether. True, the Artesian well amply supplies the place of the abandoned ones, but while the water drawn from these now dried up wells cost nothing but the pumping, a water rate is now placed on the water withdrawn from them, and its use rendered compulsory. Thus again are we driven to the importance of rain-water storage whenever practicable. In India, for instance, in places where pure water is scarce the natives adopt a simple but very effective plan for collecting and storing the rain; viz., a large sheet tied to four stakes, and a little stone put in the middle for the water to be drawn to the centre, and thus fall into the earthenware vessel placed below to receive it and convey it to the storage jars.

Mr. Sowerby Wallis, in his paper, enters into full details of

the rainfall and its distribution in this country, but to one who has resided in the Himalayas as I have done for many years, and seen the mighty factor that snow proves itself to be in the storage of water, it will be evident that in many places, even in this country, the snowfall is a valuable addition to nature's water-supply for this earth, not only as it falls but as it gradually melts, and then passes into her great reservoirs to which allusion has been made, and this it does gradually and surely, differing in this respect from a heavy rainfall, which flows off the land into the drains and rivers and thence into the sea, with but little storage having been effected in this hurried passage to its visible but temporary bourne.

The snowfall of January, 1886, gave me opportunities of making experiments on this subject to an extent which rarely occurs so far south in these islands, and I am satisfied that the freedom of this snow-water from leaves and other impurities, and the *possibility of removing the soot*, makes the snowfall a valuable addition to the water available for storage in underground tanks.

It would take up too much time to enter into the details of the important part snow plays in adding her quotum to the water-supply, but its value is very evident to those who have studied the subject in the Himalayas, where specially favorable opportunities are afforded for this inquiry, not only among the miles of glaciers, where, as the Psalmist sings, the Creator "layeth up the depths in his store-houses," but among the hill-side streams used for irrigation. The agriculturists of these mountains sow their fields, not according to the rainfall but the snowfall, as it is the gradual melting of the latter which feeds nature's reservoirs, from whence most of the hill-side streams alluded to flow. In many instances the sources of these streams are visible, and are found to be due to a remarkable natural syphonic action, which, in reality, is *nature's automatic flush*, by which her reservoirs are kept flowing at a fixed rate from six to eight months, *i.e.*, between July or August, and March or April, according to the capacity of the reservoir; for, though the date of the first burst of the water-flow is regulated by the amount of the snowfall in the winter acting on the ordinary rains, the period over which this flow extends in a fixed quantity is limited to within a few days, for the flow ceases with the same fulness and suddenness with which it began.

In calculating the rainfall in this country, and especially in the suburbs of large towns and cities, we must bear in mind the important part the late increase in roofing with slate has upon this collection, the capillarity of slate, as compared with tiles, is reduced to a minimum, while the absence of lime in the water

collected from slates is of great importance, and thus a greater amount and a purer quality of water is now capable of collection, from the roofs of the vast majority of houses, not even excepting the labourer's cottages, than could be hoped for thirty or more years ago. The picturesque thatch in country villages is now fast disappearing, before the wonderful development of the slate trade, and here the benefit of a good system of collecting and storing rain-water will be at once visible, and gladly taken advantage of, if the principle is only *cheap*, *simple* and *effective*. Undoubtedly, the late stringent regulations regarding the smoke nuisance caused by furnaces, have considerably reduced the amount of soot in the air, and on the roofs, and thus to a certain extent greatly facilitate the satisfactory storage of rain-water from the roof, if the sediment or impurities in the water could be allowed to settle, but this is impossible with the present system of admitting the water *from the top*. Again the kind of roof has an important bearing on the quantity of soot to be purified, though few roofs could be more unsatisfactory under this head than the roof of my house at Blackheath, with the water from which I have carried on my experiments since 1884. This roof is a V-shaped roof, closed at one end with a wall as high as the highest point of the roof, thus really converting my roof into a kind of soot trap. At present very few roofs are constructed on this pattern, though once it was a fashionable style for the frontage architecture of houses; the present prevailing style however is the ordinary sloping roof, from which soot is easily blown away, and finds very few places to lodge in; the difference between these kinds of roofs as regards the amount of soot in the rain-water is very considerable, and I enter into these details, as they aid in showing the severe test to which my system has been subjected.

The following is the system I have adopted, and it was exhibited in the International Health Exhibition of 1884, where it took, as I have already stated, the highest and only award, viz., a silver medal. In that Exhibition the system was exhibited with reference to the ordinary drinking water-supply, and in the Exhibition of this Institute at the Leicester Congress last year, owing to the absence of rain when the jury were examining the exhibits, it could not be seen at work; in the present Exhibition, however, it is exhibited as attached to an ordinary rain-water pipe, and, with the aid of the miniature barrel now shown, I will try and illustrate it. The chief feature of the system consists in leading the water on admission to the floor of the cistern or tank, by means of the addition (now exhibited and patented as Pringle's patent "Sursum" automatic water purifier) to the present water fittings, and then turning it up in

the centre, so that the water escapes upwards about four inches from the bottom, from whence also it is withdrawn for use. Above this outlet is placed a shield, the concavity of which is regulated in household cisterns according to the pressure in the service pipes; but for rain-water as collected from roofs with three-inch pipes, it need be very slight with a diameter of nine inches for a sixty or one hundred gallon tank or barrel, and twelve inches for larger tanks with four-inch rain-water pipes. The removal of the soot and the purification of the water take place automatically in the following manner:—The soot in the rain water, in addition to any blows it receives at any angles in its passage from the roof, is, on its arrival four inches above the floor of the cistern or settling chamber, forcibly driven against the shield; the effect of this action under water is to divide the soot into cinder and pure carbon, and while the cinder falls, and rests in the "tranquil bed," the carbon escapes to float upwards to the surface, where it gathers in much the same way that lamp black (which in many points it closely resembles) collects on any surface placed over a flame, the combustion of which is very imperfect.

This truly coal or "sursum" black as I have called it for distinction, which rises to the surface through this four feet of water, is thus exquisitely purified, and while passing through the water is in such minute portions as to be invisible to the naked eye, except as a slight tinge in the water, when placed in a pure white china cup, but is not visible when examined through the sides of an ordinary glass tumbler.

The substances which I now exhibit are these two chief constituents of ordinary soot separated by the principle just described, and I repeat that this cleansing is purely automatic, going on without any interference being necessary, or interruption experienced.

There is in this system another remarkable automatic action, which is well illustrated by drawing the water off at three different heights, viz.: 1st, at the bottom tap four inches from the floor; 2nd, at the tap half-way up the cistern or barrel; and the 3rd, from the top on a level with the overflow, after blowing aside the thin layer of coal black, which collects like a very fine scum on the surface. If this withdrawal is done by means of three tumblers it will be seen that the water is purified from above downwards, *i.e.*, the purest or most settled water is obtainable from the top, the next from the middle, and the most unsettled from the bottom tap.

The effect of the water on its entrance striking against the shield, automatically produces this purifying action, which acts further in lifting up the body of water in the cistern or barrel

by that last admitted, and thus, if the supply coming in is sufficient, all the water previously collected is removed by the overflow, and its place taken by the product of the last shower. In the case of an underground storage tank, this displaced water would pass into it by the overflow, in the same manner in which it was admitted. Thus settled and purified rain-water would alone pass into the large storage tanks, into which nothing could pass which had not been subjected to this automatic purifying process, and the cistern or barrel would thus be used as a settling and purifying tank, while, if necessary, it also might be tapped to meet daily wants, and any surplus or excess of rain after purification would pass into these large storage tanks underground. The floor of this settling chamber or cistern might be cleaned as often as necessary, by gently stirring the floor and then suddenly withdrawing the plug; this at once removes, in the rush, the cinder and other sediment too heavy to rise far from the floor, and admits of a little clean water descending to occupy the place of that lost in cleaning out the floor of the cistern.

This simple process of cleaning can be done when a shower of rain threatens, and thus the loss of water is reduced to a minimum. The testing of the condition of the floor of the settling tank for the service or rain-water can be effected at any time by simply stirring the sediment at the bottom and then drawing off a little water at the bottom tap before it has had time to settle. With reference to the cost, a most important point if the poorer classes are to be benefited, I may mention that a barrel for water, holding sixty gallons and fitted with two good taps, and this system of automatic purification can be made, all charges included, for sixteen shillings, or the apparatus alone for five shillings for a three-inch pipe, and a slight increase for pipes of larger measurements. For permanency and economy in the end, a light galvanized iron tank to hold sixty gallons would be the best and could be purchased at present for, comparatively speaking, a small sum. In the construction of a tank or cistern to act as a settling chamber for the purification of rain-water, before it passes into the storage tanks above or under the ground, it is always preferable to have the cubic contents in the height instead of the width, *i.e.*, to construct the cistern or tank more resembling a barrel in height, than an ordinary cistern in width, as the barrel conformation facilitates the automatic purification of the water by securing the perfect settling in the tranquil bed of the cinder in the soot, and other roof impurities, and thus increasing the purity of the water escaping by the overflow for storage.

After trying various expedients to remove, or rather arrest,

at once this fine carbon passing upwards to the overflow in the otherwise settled rain-water, I have found the following very cheap and simple mechanical filter effects this arrest very satisfactorily, and except under the conditions alluded to hereafter, sufficiently clears the water for drinking purposes: An ordinary thick glass cylinder, 1½ inches in diameter and eight inches long, with one end contracted to half an inch, and the other end turned slightly outwards to hold the elastic tube; after passing a small piece of sponge into the narrowed end the cylinder is filled with granulated animal charcoal, and another sponge is put in at the top to keep the charcoal from falling out; over this an elastic tube is passed and, when the other end of the tube is passed over the centre tap in the settling chamber, the water is turned on. The purifying action is only mechanical, and the two sponges and rough charcoal arrest the minute particles of carbon, and clear water is drawn off.

This mechanical action is well illustrated by the carbon gradually almost closing up the filter, so that the water at last only passes by drops, whereas it at first flowed freely; to prove this still further, if the two sponges and the charcoal are removed, and all washed in a basin of water the carbon quickly leaves the charcoal and floats to the surface, passing over the edges if more water is added, and a few squeezes of the sponges *under water* force out the carbon, which also floats away; and when sponges and charcoal are replaced as before, and the cylinder is re-attached to the tap, and the water turned on, it will be found to flow as freely as it did at first. I enter into these details, as I think they will admit of a similar filter being made at a very moderate cost, the one I now exhibit being that which I have just described, and it cost only one shilling. I do not wish it to be understood, that the system I recommend will effectually remove all roof impurities carried down the rain-water pipes into the storage cisterns or tanks, but merely, that it will place these impurities as far as possible out of the reach of passing into the water drawn off for domestic, or passing off for storage purposes, by permitting them to rest in the tranquil bed, and here to remain undisturbed either by any more roof impurities passing through the water downwards, or the constant disturbance produced by the admission of the water collected, it may be from a passing shower. There is however one species of roof impurity which I consider must seriously interfere with any attempt, either at purification or storage. I allude to the droppings of pigeons on the roof, though, if any substance will minimize the injurious action of these and similar impurities, it is the constant passage of minute portions of a deodorizing and antiseptic substance like carbon through the water.

A necessary warning appears advisable here, viz., that lead should in no way be brought into contact with the rain-water, as from some experiments I made by storing water in a glass cistern, with a standing overflow lead pipe fixed at the bottom of the cistern, I am satisfied from the special opportunities the glass sides of the cistern gave me of watching the action of this rain-water on the lead, that its injurious effects must be not only very considerable, but very rapid; fortunately zinc or galvanized iron can completely supplant lead, without the slightest risk of any injurious action resulting.

A late writer in a popular periodical describes the London water-supply as follows: "The most characteristic feature of the London water is its hardness." And such being the case, the value of collecting rain water for washing purposes, not for clothes only, but for the skin, is self-apparent, but the "London blacks" have hitherto put an effectual barrier on the attempt; if, however, they can be overcome, there can be little doubt the collection of rain-water would be readily undertaken. Indeed in many suburban residences attempts are even now made, and I have known, among the poor washerwomen, of an old sack being tied to a rain-water pipe in hopes "to stop the blacks." Some of us may also have seen water in white china basins into which we almost hesitated to plunge our faces, fearing they might come out, even on our return from London blacker than they went in.

While on the subject of soft water for washing, I may mention that the very hard water of the Kent Water Company, and other companies drawing their water from the chalk strata, very often produces in children, and sometimes in adults, no matter what soap is used, an eruption on the face and hands, due to the lime in this water, and its action on the skin, when cold or east winds have to be encountered; this has sometimes been mistaken for a constitutional disease, for which various internal and local remedies have been given and applied, but which a little rain-water has completely removed.

In conclusion, I would only state that the coal, or, as I have termed it, "sursum" black (to distinguish it from the bone, lamp, spirit, and gas black of commerce) which I now exhibit and which can be collected in quantities varying with the amount of soot in the air, from the surface of this settling chamber, or when dried from the bags fastened over the pipe of the overflow, has a distinct marketable value, and, in point of density of colour and purity, is superior to the best black of commerce, viz., spirit black, gas black being so little collected that the supply cannot be relied on. The superiority of the "sursum," or coal black, need not be a matter of surprise, the

process of purification it undergoes, and the minute division in which it passes through a body of water varying from 3 to 4 ft. in depth to float on the surface, must, I think, place it, when compared by the ordinary methods of comparison with other blacks, in a high class as regards purity, minuteness of division, and hence lightness, freedom from grit or cinder, hence facility and thoroughness of mixing, and intensity and deepness of color.

The cinder, as collected from the "tranquil bed," when thoroughly dried, has also a marketable though inferior value, as it is only applicable for the coarser kinds of black paint. I would close by adding that it seems certainly a new and favorable point from which to view "London soot," viz., as containing a substance capable of forming the basis of a black pigment superior to that of any similarly-prepared pigment in the market and a carbon of great purity—all to be done automatically, without further expense, trouble, or interruption, and thus possibly to prove, as in the case of the refuse of gas coal, "a valuable residual."

LECTURE TO THE CONGRESS,

BY

Captain Douglas Galton, C.B., D.C.L., F.R.S., &c.

The object of the Sanitary Institute in holding an Annual Congress is to endeavour to excite the interest of the community in sanitary knowledge; and I do not think that I can occupy your time more usefully this evening than by drawing your attention to one of the most valuable pieces of work which the Sanitary Institute performed last year, and which bears a special relation to the question of the prevention of disease, viz., the publication, under the auspices of the Sanitary Institute, of *Selections from the Reports and Writings of Dr. Farr, on Vital Statistics*, under the editorship of our eminent member, Mr. Noel Humphreys.

Dr. Farr laboured successfully, in forwarding the science of vital statistics, for little short of half a century. Indeed, I may say that in this country no one has rendered a greater service to this branch of sanitary investigation than Dr. Farr, and the pages of Mr. Humphreys' collation of Dr. Farr's work are so replete with interest that I trust that the account of some of his views on practical sanitation, which I shall be able to mention to-night, will be the means of inducing many of you to study them for yourselves.

The science of vital statistics lies at the foundation of all accuracy in sanitary research. The national registration of the causes of deaths, which has only been systematically carried on over the whole country since 1838, has given greater prominence to the principles of physic, and has enabled the science of medicine, like other natural sciences, to abandon vague conjecture for facts accurately determined by observation, and to substitute numerical expressions for uncertain assertions.

The registration of the causes of deaths necessarily leads on to further investigation.

For instance, it induces the study of the locality in which

the people live, its climate, its soil, its drainage, the density of its population, and the mode in which they are housed.

It induces inquiries into the wealth or poverty of the people, their means of obtaining food and clothing, into their occupations and social position, and the proportion of each class to the whole and to one another.

It leads to the consideration of the age-composition of the population, *i.e.*, the population living at each age, or ætal period, and, therefore, their expectation of life; and of the relations of births, marriages, and deaths to one another and to the population.

It further leads to enquiries into the causes of the diseases of which the people die.

Hence the study of vital statistics has been the means of inducing a great development of practical sanitation; it has brought prominently into notice the fact that the propagation of a certain class of diseases, from which large numbers of the population die, is favoured and assisted by preventible causes; and that if these causes favouring their propagation were removed and means were taken to check their spreading, the class of what has been termed preventible diseases might be expected to disappear.

It would only weary you if I were to attempt to give you a condensed summary of what this very interesting volume contains. I propose therefore to limit myself to directing your attention to one or two of the lessons which Dr. Farr has inculcated, which have a special bearing upon our future progress in sanitation, and which are more especially connected with the application of sanitary principles to practice. I will, however, in the first place, briefly allude to the method of which Dr. Farr makes use, to show in a definite form the pecuniary advantages which the community derive from healthy conditions, that is to say the economical value of sanitation.

Economical Value of Sanitation.

By the term economical value, I would wish to imply not only the large money value which a healthy population may be said to possess, as compared with an unhealthy population, by reason of its greater power of work and diminished outlay for defraying the cost incidental to disease, and to the support of the diseased and incapacitated members of the community, but also the much larger amount of individual happiness which the healthy population enjoys; and in this connection you will remember that at our meeting at Glasgow, Dr. Richardson gave us a most interesting lecture on Felicity as a sanitary research. He then shewed us that felicity stands precisely in

the same position as health; that in its widest sense it means health, and is another word for health.

In order to estimate the money value of life, we must bear in mind that in its production and education a certain amount of capital is sunk for a longer or shorter time; capital thus sunk, with its interest, as a general rule reappears in the wages of the labourer, the pay of the officer, and the income of the professional man. The labour of the parents, and the expense of attendance, nurture, clothing, lodging, education, apprenticeship, practice, are investments of capital, at risk, extending over many years, and the return appears in the form of the wages, salaries, or incomes, of the survivors.

The outgoings increase from infancy up to a certain age; the earnings then commence, and ere long equal the outgoings; the earnings continue subsequently in excess throughout manhood, but as life advances they decrease, until they are extinguished amidst the feebleness and infirmities of old age. The present value of the person's probable future earnings, minus the necessary outgoings in realizing those earnings, is the present value of that person's services. Like capital invested in the soil, in the vintage, or in a commercial adventure, the capital invested in the life of a man returns, in happy natures, profit of a hundred-fold; in other cases fifty, twenty, ten-fold; in others it is barely returned; in some it is entirely lost, either by death, sickness, vice, idleness, or misfortune.

At first it is all expenditure, and a certain necessary expenditure goes on to the end, to keep life in being, even when its economic results are negative.

The value of any class of lives is determined by valuing first at birth, or at any age, the cost of future maintenance, and then the value of the future earnings.

Proceeding on this method Dr. Farr estimates that for an agricultural labourer on good wages the present value of a child at birth is £5, at 5 years old £56, at 10 years old £117. The present value of a youth at 15 is £192. The present value of a young man at 20 is £234, and the man at 25 is £246. But after that age the prospective value decreases, and at 30 years of age it is £241, at 55 years of age it is £138, at 70 years of age it is £1.

The cost of maintenance afterwards exceeding the earnings the value becomes negative: at 80 the value of the cost of maintenance exceeds the value of the earnings by £41.

These values are borne out on a comparison made with the former cost of slaves in Rome, in the United States, and in the West Indies.

The amount of capital sunk in the education of professional men is not only much greater but it is probably at greater risk, and it has to remain longer under investment before it is returned. The maximum value of such a man is attained later in life, probably at 40 years of age, and in the highest orders of the Church, law, and politics, where experience and great weight of character are requisite, the life increases in value at still higher ages.

Thus, until the period of old age is reached, life has a definite money value, small in childhood, increasing to middle age, and then declining in old age.

This money value is, however, dependent on the health of the population. Dr. Farr gives an average, but the average in a healthy population would be very much higher than in an unhealthy one, in which the children were sickly, the youths stunted, and manhood weakened by early disease, and cut off in its prime.

It has been often said that the comparative health of different populations may be judged by the deaths of the children. This may be true as to the death-rate, but the deaths of children depend on many contingencies which would not necessarily affect the general health.

It would seem that in England nearly half of the deaths is made up of the young under ten years of age, and of these deaths by far the largest proportion is of children under one year of age.

The agencies which destroy infant life are many, and they vary in different localities. Some of the principal causes are improper and insufficient food, bad management, use of opiates, neglect, early marriages, and debility of mothers; but whatever may be the special agencies at work which are so prejudicial to infant life, it must be borne in mind that a high death-rate among children is also in a great measure due to bad sanitary arrangements.

About one-seventh of the population die of what Dr. Farr termed filth diseases, and probably five-sixths of the deaths from these diseases are of children under ten years of age.

As evidencing the influences of insanitary conditions on the death-rate of children, I may mention that I was reading a letter the other day from the Sanitary Commissioner with the Government of Bombay, who mentioned that in the town of Ahmedabad, in India, the general death-rate is permanently 53 per 1000 annually; and the children under one year die at the rate of 333 per 1000, or one out of every three born dies within the first year of life; and he stated that this is owing to the whole town being perforated with filth wells, into which

all refuse has been thrown for generations, and to the water being drawn from wells situated in the soil thus perforated—the air above these sources of impurity and the water in the soil being equally polluted.

It is melancholy to think of the large number of children who thus drop off like withered buds: they, however, are removed from their misery; they do not become a burden to the community, and their early removal prevents them from transmitting the defects arising from their low health to a future generation.

It may be taken as a fairly correct assumption that a large death-rate is generally an index of the existence of much misery among the survivors.

For instance, the death-rate will probably be large if the people are employed at unhealthy occupations, and if the population includes an undue proportion of young children or very old people; or, indeed, if a population is badly fed, badly housed, and the district is badly drained, we may also expect to find a high death-rate, even although the occupations are healthy, and the age constitution of the population duly proportioned.

On the other hand, if a people be well-fed, well-housed, and well-clothed (in fact well-off), and the district be well-drained and the climate moderate, we may expect, all other things being equal, to find a low death-rate.

Enquiries into the relation between sickness and death shew that there are from ten to fifteen, or sometimes more, cases of sickness to each case of death, and an analysis of these cases of sickness will generally shew that the majority of cases consists of children and the very young, or of the very old.

Dr. Farr tells us that in manhood, at the age when the earning power is greatest, there are two people permanently sick for every death. That is to say, that every death represents a loss of the wage-earning capacity of three persons.

Therefore, a large death-rate, which in itself is in great measure due to the deaths of children, represents a large amount of sickness amongst the surviving children whose after-life suffers permanent injury, and whose earning power as adults is thus reduced.

Hence the loss to the community in money power from death and disease is partly due to the actual loss of the power of earning wages of those who die, or are disabled by sickness in the fulness of life, and partly by the diminished earning power of those raised from sickly children, whose stamina has been destroyed by disease in childhood, and of whom many can only be a burden to themselves and to the community in after life.

But such a calculation takes no account of the diminished

capacity for happiness and enjoyment, of the pain suffered, and weary lives endured by those who are actually sick, and of the absence of full energy in those who, having grown up with the brand of a sickly childhood, are unable to echo the thanksgiving, "We bless Thee for our creation."

That part of the ill-health from which these children suffer which is due to defective sanitation at least is remediable, and it is the duty of the community to take steps to ensure that the insanitary conditions shall be removed.

In pursuance of that duty numerous laws have been passed, but it is only lately that the nation has begun to awake to the fact that if it is the duty of the community to prevent the use of bad water or of adulterated food, it is equally their duty to see that all persons who build houses shall build them so as to be healthy, and shall keep them in a healthy condition. In fact, no man is entitled to create property, or to use property, so as to be a source of danger to others.

If this had been recognised earlier, the vast number of insanitary dwellings in our towns would never have come into existence.

To remedy the evils which have been permitted to arise must entail expense in the near future upon individuals as well as upon public bodies, for it is certain that as a measure of safety to the well-to-do classes, insanitary dwellings must be abolished all over the country, and if private owners decline to provide healthy dwellings for the poorer classes the duty must fall on the community.

Dangers from Increasing Density of Population.

You will say that in bringing before you the importance of Dr. Farr's work, I am telling you nothing new, and that is so; but it is something to make you think of these things. I want you to realize that our danger is increasing at a very rapid rate, owing to the great increase of population which is continually going on in the limited area of this island.

Dr. Farr tells us that propinquity alone is a cause of an increased death-rate. On comparing certain groups of population in relation to the density, Dr. Farr shews that there is in these groups a constant increase of mortality running parallel with the increase of density.

Indeed, I think that unless special care is taken to provide for the sanitation of a population in proportion to the increase of its density, you may assume that if a population on a definite area increases in an arithmetical progression, the dangers to its health will increase in a geometrical ratio.

Therefore increase of population *per se* in this island may be said to be a cause of increased sickness and mortality, provided adequate provision be not made to counteract the evils.

With proper care it is quite possible to counteract many of the dangers which prevail in a dense population.

For whilst in a dense population the exhalations into the air are thicker, yet nature has arranged that the movements of the atmosphere are so rapid and so incessant that we can be sure that, with the limits yet known, however large our city is, we shall get a supply of fresh air which will remove the exhalations, provided we take the precaution so to arrange the buildings as to facilitate the circulation of air between them instead of arranging them as you generally do to obstruct it, and if we check the creation of the black smoke which forms a permanent canopy over so many of our towns; moreover if we take pains to secure the removal and destruction of refuse and provide an adequate water supply, and sufficient arrangements for drainage and cleansing, as such matters can easily be provided by combination in towns, the evils which have generally made dense districts so fatal may be mitigated. Indeed, the recent improvements in some of the denser districts of our cities in the present day have made them comparatively salubrious.

In connection with this question, I was much struck with an offer made last year by the Duke of Westminster to the National Health Society. On his valuable estate near Grosvenor Square, in London, he had some building leases which fell in, and he offered a site to the Society for the purpose of building a sanitary house. The proposal fell through; but the proposal leads one to consider the question, why are sanitary houses so rare in London?

The real difficulty of building a sanitary house in London is, that the land is so dear that when a site is once procured every inch of it is endeavoured to be occupied with buildings, and this prevents any circulation of air. It is here that the municipal authorities frequently have been, and still are, so seriously to blame. Why, if they think it necessary to obtain legislative powers to enable them to make regulations for removing the sewage from, and bringing pure water into a city, have they not equally obtained legal authority empowering them to lay down rules to secure good air? As I have already said, nature is always ready to help them. It only requires that the houses should be arranged so as to allow of free circulation of air, and that the measures which exist in abundance to prevent the atmosphere from being polluted with black smoke should be enforced, and the constant movement of the atmosphere will do all the rest. To secure however the free circulation of air it

would be necessary to prevent any building site being entirely covered with buildings.

If the various municipal authorities could and would insist that all buildings in towns should be designed and built in such a manner that air could penetrate freely and directly from the outside to every part of the inside of the building, and if they could and would, moreover, provide that, both in front and at the back, all buildings should be separated from adjacent buildings by a space at least equal to twice their height, we should ensure free circulation of air between and around all buildings.

It may be urged that the property in towns would not fetch so high a price if it were not allowed to be crowded with buildings, but no owner of property has the right to allow it to be used so as to be a source of injury to the community; and where populations aggregate together in the way they do in our large towns, the owner of property, to whom so large a profit comes from what has been termed the unearned increment, would have certainly little cause to complain if he were required to pay some attention to the health of the occupants of both his and of the surrounding property, from whom his enormous profits are derived.

Thus, whilst density of population is of itself a cause of danger, it is yet a cause which might be counteracted by increased precaution.

In England our population is daily becoming more and more dense, and although we have made great progress of late years in sanitary procedure, our progress has with difficulty kept pace with the increased requirements which result from the growing density of population.

It is certain that if we removed all insanitary causes from our midst we might reduce the death-rate of the country generally to that of our most healthy towns—probably to from 13 to 15 per 1000, instead of 20 to 23. See what has been done in the Army. The mortality of the Army before 1857 at the home stations was nearly 18 per 1000; in the year 1884, the last year for which the statistics have been published, it was 5·4 per 1000.

No doubt we have had, in addition to the sanitary improvements in barracks and the great attention paid to other matters affecting the health of the soldier, the advantage of the short service; but still with every allowance the improvement is very great.

Seeing the success which has attended these efforts, and the favourable results which have followed all improvements in town sanitation, we may well ask ourselves how it happens that after

so many years have been spent in the study, and so much experience has been gained in the practice of sanitation, and since every well-directed effort has been followed by success, we have as yet made comparatively little progress. It is true that our knowledge of sanitation is much more widespread and our condition is far better than it was formerly, but we are battling against a foe who is daily becoming stronger from the inherent conditions of our population. The growth of population does not stand still—no more, therefore, can we stand still. We must daily increase our vigilance, and daily seek out and counteract the fresh causes of disease which are continually springing up.

Direction of Sanitary Effort.

I think there are four matters needed, greater attention to which would be followed by material improvement to the public health.

(1.) *Sanitary Education.*

In the first place, the study of sanitary science has not been made an integral part of the education of our children. It has been well said that it is through the education of the young that you must influence the life of a nation.

(2.) *Legislation.*

In the next place our legislation is defective, our sanitary areas were arbitrarily fixed and are not satisfactorily adjusted. We have no adequate supervision over our rivers. The density of our population leads to pollution of our rivers, and yet we are satisfied to take no steps to prevent this pollution.

We take no steps to prevent floods, which leave their traces in sickness and low health of the population exposed to their influence.

We have no adequate supervision over the sanitation of houses, especially in towns.

We have not yet thoroughly realised that the house drainage is just as important a part of the sanitation of our towns as the town sewerage, and one in which all inhabitants are equally concerned, for the existence of insanitary spots in a crowded population is itself a source of danger to all.

If the municipal authority has found it necessary to spend large sums on providing a new and efficient system of sewerage

for the town, it is equally imperative that it should require the individual householder to supplement that work by providing the complement or continuation of that system in his own house.

Public feeling has recently found some expression on this subject. The year before last, in the draft Bill for the Housing of the Laboring Classes, it was proposed that any person who let a house furnished or unfurnished, which was in an insanitary condition, should be pecuniarily liable to the lessee or occupier of the house for any illness which might result. This provision was not made part of the Act, but in the first Session of 1886 a Bill was introduced which proposed to constitute the local authorities charged with the administration of public health as sanitary registration authorities in their respective districts, and it provided that previous to June 1, 1888, each sanitary registration authority constituted by the Act was to cause notice to be sent to the owner, lessee, sub-lessee, or occupier of every building occupied or intended to be occupied, either permanently or temporarily within the area of its jurisdiction, calling upon the said owner, lessee, sub-lessee, or occupier, to deposit with the registration authority a certificate for such building. The Bill further provided that previous to January 1, 1889, the owner, lessee, sub-lessee, or occupier of every such building was to cause a certificate to be deposited with the registration authority declaring that the said building is in a satisfactory sanitary condition, such certificate to be signed or sealed by some one of the following persons or corporations, that is to say—Members of the Royal Institute of British Architects and Members of the Institution of Civil Engineers, who are in practice as architects, surveyors, or civil engineers; also architects or civil engineers who have been in practice five years at the passing of this Act, and who register their names accordingly with the Local Government Board before January 1, 1887; also by Sanitary Associations incorporated by license of the Board of Trade, medical officers of health and medical practitioners qualified in sanitary science; also by the surveyors and engineers of local authorities so far as their own districts are concerned, and such other persons as the Local Government Board may authorise.

The Bill further proposed to provide that after January 1, 1889, it should not be lawful for any dwelling house, school, hotel, hospital, or other building, to be occupied either permanently or temporarily, unless a certificate had been deposited with the said registration authority in accordance with the provisions of the Act.

The Bill did not become law, but it is certain that before long steps will be taken in the direction of the proposals incorporated in it.

(3.) *Trained Sanitary Advisers.*

In the third place we require trained advisers in practical sanitation. Your medical officer of health has qualified himself for his position, for he cannot be admitted into his profession until he has passed necessary examinations ; but it seems to be considered that any engineer, whether he has studied sanitary science or not, is qualified to have charge of the sanitation of a town, and often that any person, whatever his previous occupation, will do for a sanitary inspector or inspector of nuisances. But this is a fallacy, for consider for a moment the variety of matters by which the health of the community is daily endangered. We are touched at every point by disease causes. For instance, in the question of food, there is selection of food, adulteration of food, and preservation of food.

A few years ago a great outbreak of typhoid fever in London was attributed to pollution of milk by sewer gas ; the milk received from the country having been stored by the milkman in a confined place in the basement of a London house, to which there was direct access from a main sewer.

Newer theories allege that the habits and diseases of animals are closely associated with the disease causes of the human race, and that scarlet fever may sometimes have its origin in the neglect to notice a specific disease in the cows from which you obtain milk.

But even where our attention is awakened, and where we have introduced sanitary works, we often find that causes of disease arise which are intimately associated with the sanitary improvements which we have devised. Your well water may in itself be pure, but it may become polluted from infiltration, because you or your neighbours place at no great distance from the well a heap of refuse, or because you let the paving round the well get out of order, so that dirty surface water finds its way in. The water pumped into your cisterns may be pure, but if your cisterns are not carefully arranged, and if you do not clean them the water in them may become polluted, and then they may themselves be a source of danger.

The filter on which you rely, if used for many weeks without cleaning, may make water, otherwise wholesome, dangerous to drink.

You have ventilating openings ; but the tubes or flues which bring in fresh air will, especially in closely inhabited areas unless frequently cleaned, become receptacles of dirt, and render the air foul.

You have hot water pipes to warm your house ; but if these are placed in chases in the wall, or in flues where dirt is allowed

to accumulate, they will assist in spreading impure air in your house.

Your drains may be designed on the best principles; but they are concealed in the ground, and unless they are carefully made, sound and water-tight, they may pollute the ground below your house, and become a source of eminent danger.

Let me give you an illustration; it happened only a fortnight ago:—

I am on the council of the Girls' Public Day School Company. We have above 30 schools; we employed a gentleman of eminence as Architect of such buildings to build one of our largest schools; recently we felt it desirable to examine the drainage of all our schools. Let me tell you what was the report on the condition of the drainage of this particular school, which drainage passes under the building: "To a great extent the drains not only fall the wrong way, but are absolutely without any jointing in many cases. In another case the pipes do not meet within two inches, and here a joint has been made with zinc and string; this is under the kitchen."

Is it not remarkable that an architect of position should have permitted the drainage under this school building to be constructed in such a manner as practically to ensure that the ground should in course of time be saturated with sewage? The only inference which can be drawn is, that the architect cannot have understood much of sanitation; for any other supposition would imply that he cared little for the lives of the hundreds of children who were to be congregated in the building.

Again, your house may be constructed upon the best sanitary principles; your drains may be sound and water-tight; and everything may be beyond suspicion as to freedom from sewer gas, or impurity in the water supply; but if that house is constructed, as is so frequently the case, upon ground which has been used for refuse and rubbish heaps, the good drainage within the house will be no security against the penetration of foul gases from below.

Let me give you an illustration also of this peril. It has lately happened to a friend, with whom I am intimately acquainted, that, although his house had been built with every possible care as to sanitary matters, there were repeated outbreaks of scarlet fever among his family and household. Every expert who enquired into the causes of these outbreaks failed to discover any flaw in the internal arrangements; but upon enquiries being made in the neighbourhood, it was found that the whole row of houses had been built upon rubbish heaps, and that every house in the row had had outbreaks of fever.

Indeed the more we pursue our sanitary enquiries the more

do we see the complexity of the problem; and hence investigations into disease causes and into the sanitary condition of a locality or of a house, in order to be thorough, require skill and experience.

Sanitary work, to be of much value, or of a comprehensive nature, must be undertaken with a clear idea of the dangers to be averted, and the good to be attained. It is a scientific work, and scientific methods must be adopted.

It is because neglect is so common, or because so frequently a person who has no real knowledge of sanitary science has been called in to devise remedies for what he does not understand, that sanitary science has often been discredited, and that much expense has been incurred in so-called sanitary works which have not only had no useful effect in themselves, but which have produced new and hitherto unsuspected causes of disease.

(4.) *Notification and Isolation of Infectious Disease.*

There is, however, one matter of sanitation in which we are singularly remiss, and that is the arresting of infectious disease at its first appearance.

Dr. Farr's pages show you that in tracing out the sanitary history of a community the statistics of illness from those diseases which are favoured by insanitary conditions are as essential to possess as the statistics of the deaths. Indeed, sanitation can only rest upon a sure basis provided the statistics of sickness from epidemic diseases, as well as those of death and the probable causes of these occurrences, are accurately recorded and intelligently studied.

The registration of sickness would designate the localities where disease is most rife, as well as those where there is less tendency to particular classes of disease and infirmity; it would, moreover, indicate the extent to which epidemics vary in different localities, seasons, and classes of society. But, to obtain this knowledge with accuracy, it would be necessary that all the cases of epidemic disease, as well as of the deaths, should be accurately recorded, collated, and carefully considered, by skilled persons, in their relation to the conditions which prevail in the several localities where they occur; and that the areas of registration should be smaller than they now usually are, and that they should be more carefully adapted to the sanitary condition of the localities.

Notwithstanding all Dr. Farr has done, we have by no means perfected our system of vital statistics, for we have not yet established any general registration of epidemic disease.

It is true that for certain towns the notification of certain

infectious maladies is enforced; but what we want is that this should be extended to the whole kingdom, and that the sanitary authority in every locality should be informed at once of every case of dangerous infectious disease occurring in the district, and that the sanitary authority should be empowered and required to see that the case is at once isolated. This would be a step of forward progress, the importance of which is illustrated by some remarks in an address made by my friend Mr. Michael, Q.C., to the Sanitary Institute on this subject:—

"How do we deal at the present time with cases of infectious diseases occurring in our midst, one of the great sources of danger to the public health which we can easily stamp out, but which we deliberately allow to run on its course unmolested? If a member of our own family should unhappily be laid up with an attack of measles or scarlet fever, we, as soon as it is known, become isolated and cut off from our social belongings. Our friends no longer call upon us, we are prevented from going into society, and our acquaintances when they meet us rein up their horses at a safe distance from the curb of the pavement on which we stand, while they enquire as to the sanitary condition of our little home community. At the same time these very friends and acquaintances, in shops or warehouses which they frequent or use, in laundries, and in workshops, are daily shaking hands with infection, and dealing directly with persons who come straight from their habitations where infectious disease is present, and who, in their clothes and otherwise, convey to the unsuspecting the matters which engender disease. The tailor who makes or mends our coat does so in the company of measles or small-pox; the laundress, who is busy with the garments soon to be applied as coverings to those we love best, bestows her care equally on the snowy surface of our linen, and on the scarlet desquamating skin of her child, and then we wonder at the spread of infectious disease, and that so little good results from sanitary measures, as though sewer and ventilating apparatus outside our houses were all the protection that is required to ward off disease, and that the interiors, and all that there occurs, is beyond the need of our attention and our laws."

Instances are numerous of the evils resulting from the want of isolation. Let me quote one from the Report of the Royal Commission on Small-pox and Fever Hospitals:

"A very remarkable case occurred two or three days ago; six children were admitted upon Saturday night last to the hospital at Stockwell. They all belonged to one family, and lived in a small apartment at the top of the Haymarket; their father is a tailor working for a fashionable tailor in the West

End of London. About three weeks ago one of his sons (there were nine in family altogether) had small-pox, which was treated at home, and was not notified. All the others caught it. The six children were all brought into the hospital on Saturday night. All the nurses who witnessed their arrival said that they had never seen such a horrible sight. One boy died four hours after admission, two girls died three days afterwards, and three are still left exceedingly ill; the ages of the children being from fifteen to three years. Now if the first case that occurred had been notified and isolated, all this distress and misery might have been avoided.

"In the lower floor of the house where the tailor lived was a laundry employing five women, who came every day, where washing was taken in from the neighbouring families."

Similarly, in regard to scarlet fever, it is instanced in the same Report that in the Alcester rural district in Warwickshire, the early removal of cases of scarlet fever from houses which contained children, who were unprotected by having had previous attacks, had prevented any spread of infection. For example, in three instances the first pupil attacked had been removed from school, and in each of those cases no spread took place; whereas on another occasion when scarlet fever attacked a pupil at a school, and it was attempted to treat it in isolation in the school building, the disease spread, and seven other attacks followed in the schoolhouse.

As a contrast to this, let me quote to you the experience of Leicester, which we visited last year.

Now, that town is very heterodox in some of its opinions. The population seems to reject the theory which is, I may say, now all but universally accepted by civilized mankind, that that dreadful scourge of small-pox should be arrested by compulsory vaccination. The efficacy of vaccination and re-vaccination in checking the ravages of small-pox has been fully proved by a practice which has extended over nearly a century of time, and which has been in operation in every civilized community on the face of the globe. But what I want to draw your attention to is this, that whilst Leicester declines to believe in the necessity for compulsory vaccination, it has yet enjoyed for many years an immunity from epidemics of small-pox.

This temporary immunity has been attained by strict care. Leicester has long stood forward as a pioneer of sanitation, and as a sequence to its other sanitary work, Leicester was one of the first towns to procure an Act for the Notification of Infectious diseases. As soon as a case of small-pox is notified, the Municipal Authority takes immediate steps to remove the case

to hospital, and to disinfect premises and clothing. They also persuade the occupants of the house where the case is found to go into quarantine for a fortnight at the expense of the town. The necessity for this has been proved, as persons so removed were sometimes found in two or three days to be affected with the disease. They have no compulsory power beyond that given by the Public Health Act, which applied all over the kingdom; but if householders refused to go into quarantine they would send an officer every day to enquire at the house, so that the danger of infection should be reduced, and of course it would be their duty to warn persons of the penalties they were liable to if they exposed others to contagion.

In Leicester, in 1852, there were fifty-two deaths from small pox, in 1858 there were fifty-three, in 1864 there were 104, and in 1872 there were 346; that was before they had the Notification Act, or any means of efficient isolation; since that time, and under their present method, they have not had a single epidemic of small-pox, and a large number of single imported cases have been dealt with, and the disease in each instance stamped out. Similarly I am informed that small-pox has been kept away from Cheltenham, which has no compulsory Notification of Diseases Act, but where the medical men are all strongly interested in stamping out the disease.

It is said that the compulsory notification of infectious diseases is not looked upon favourably by medical men. I will therefore quote the experience of the Medical Officer of Health of Leicester on this subject:

"It is now over four years since the notification of their infectious cases was first required of the medical men in the town, and I am happy to say that the evils anticipated by the profession from their fulfilment of this duty have in no way been realised. Their carrying out of the clause, at first considered so objectionable, affords conclusive proof that the fears entertained as to the result of 'breach of confidence' upon their part to the patients under their care have had no actual foundation in practice, for no single instance has come to my knowledge where notification has in any way disturbed the previously-existing relation between a medical man and his patient. The profession now fully co-operate with the Health Committee in this matter."

I quote this experience because it shows how much may be done by isolation to prevent the spread of an epidemic, even as virulent and contagious as small-pox. The object to attain in the case of infectious diseases, such as small-pox, scarlet fever, diphtheria, and others, is the immediate isolation of the patient when the disease first shows itself. Certain conditions are

necessary to secure this. The first is, that every case of infectious disease should be promptly notified to the authorities. Second, that the patient should be at once isolated; thirdly, those who had been in immediate contact with the patient should be retained for a period under observation; fourthly, the premises where the case occurred should be cleansed and disinfected, and any sanitary defects in them should be remedied.

In the enforcement of these conditions there should be no distinction between rich and poor, pauper and non-pauper cases, except the distinction between persons who can and persons who cannot be isolated at their homes, or in some place approved by the proper authorities. In default of such isolation, the authorities should be empowered and bound to remove to the hospital any patient capable of removal without risk to life or aggravation of the disease.

I have been the more anxious to bring this question to your notice, because the rapid increase of our population in the restricted area of this island makes it imperative that we should adopt every precaution which our advancing knowledge points out to mitigate the tendency to the spread of disease which Dr. Farr has shown to be inherent to an increase of population, when additional sanitary precautions do not follow that increase.

In the metropolis this question is of especial moment. There, at the rate of increase which has been steadily maintained since the beginning of this century, the population will in another twenty years amount to probably 6,000,000. Considering how large is this aggregation of human beings, we must acknowledge the great progress which has been made of late years in the preservation of the health and prolongation of life; because, even if in late years the death-rate had remained stationary, we might have congratulated ourselves upon having at least overcome the effect of the increase of density of population by our sanitary measures; but in fact the rate of mortality has actually and largely diminished. We may attribute this gratifying fact in part to improved drainage, and to the large amount of wretched house property which has been cleared away under the various Acts for improving the dwellings of the labouring classes, by which, not only have improved dwellings been substituted, but open spaces have been created, admitting of circulation of air, and preventing the accumulation of refuse in the inside of the dwellings. Moreover, the metropolis has spent large sums of money in endeavouring to cope with epidemics of small-pox and fever. The care of those who suffer from these diseases has fallen to the lot of the Metropolitan Asylums Board, who opened three hospitals in London in 1870

and 1871, and two more at the beginning of 1877, under the provisions of the Metropolitan Poor Act, 1867.

On referring to the Registrar General's Report for 1883, you will find there is a Table shewing zymotic diseases for certain decennial periods.

From this Table it appears that the deaths in London from small-pox between 1841-50 were at the rate of ·4 per 1000 persons; 1851-60 were at the rate of ·28 per 1000 persons; 1861-70 were at the rate of ·28 per 1000 persons; 1871-80 were at the rate of ·46 per 1000 persons—that is to say, in this last decade the death-rate from small-pox averaged nearly two-fifths more than it had been in the two previous decades, and in 1881 it was ·62 per 1000.

Whilst, therefore, the rate-payers of London were spending large sums of money in the treatment of small-pox, the disease which should have been limited, if not prevented by the expenditure, seemed to increase rather than decrease its ravages.

But during the last severe epidemic of small-pox, which began in 1884 and ended in 1885, the Metropolitan Asylums Board took a new departure; they arranged to remove all cases of small-pox from within the metropolis, and treat them away from the population; the system now in force is to convey the patients by ambulance carriages and ambulance steamers to hospital ships in the river at Long Reach, 20 miles below London Bridge, and when they begin to convalesce to remove them by an easy drive to a healthy site at Darenth, on the range of hills not far from Dartford, where they remain till they are considered free from infection.

At the present time there is very little, if any, small-pox in the metropolis; we may assume that this is in some degree the result of the action of the Metropolitan Asylums Board in at once removing all cases from the midst of the population; but there are also individual agencies which assist. For instance, some of the Medical Officers of Health seek "voluntary notification;" Dr. Dudfield, of St. Mary Abbotts, Kensington, mentions in his last report the sources from which he obtains information of the occurrence of infectious diseases in his parish. These are Sub-district Registrars, Sanitary Inspectors, Relieving Officers, the Asylums Board, Resident Medical Officers of Hospitals and Dispensaries, Medical Men, the Police, the Postal Authorities, School Board Visitors, Clergymen, and District Visitors. I mention these to shew the difficulties which meet the energetic Medical Officer of Health who seeks "voluntary notification." But notwithstanding these difficulties, Dr. Dudfield shows satisfactory results. A comparison of the 12 years period 1859–70, before voluntary notification and Hospitals,

and the 12 years period 1871–82, with voluntary notification and with Hospitals, shews that there was a net decrease of infectious disease in the second period amounting to an estimated saving of 1441 lives. The progress which we have made in checking infectious disease is an evidence that we ought not to be content with what we have already done; we ought to take a further step. For the metropolis, with its daily increasing population, is consequently subject to a continually increasing risk from infectious disease; and yet it neglects in these arrangements one of the links in the chain of prevention which is shewn by the experience of Leicester and nearly 40 other large towns to be so important.

The notification of disease, the isolation of all patients whether rich or poor, the careful observation of all those who have been in contact with the patient, the disinfection of the house in which the patient resided at the time of his attack, and the removal of any sanitary defects which may be found in the house, I have already shewn to be links in the same chain. They are necessarily more difficult to secure in a great city like London which, nevertheless, all things considered, enjoys a remarkable degree of salubrity with a comparatively small zymotic death-rate. Nevertheless, it must be said that until similar measures are made compulsory in the metropolis, and in the country generally, we are neglecting a powerful means of preventing the spread of small-pox and other infectious diseases.

The metropolis, unlike other towns, is not under one municipal authority; the direct management of the infectious hospitals in the metropolis is under the Metropolitan Asylums Board, but this Board has no initiative power, and its proceedings are controlled in great detail by the Local Government Board. That Board is charged with the control of the sanitary legislation of the whole country; and seeing the success which has been attained in those towns which have of themselves adopted the notification of epidemic disease, that Board is neglecting a grave duty by not making any effort to induce Parliament to protect the community from epidemics by introducing and securing the success of a measure providing for the notification and isolation of epidemic disease.

Conclusion.

In this address I have been barely able to touch upon a very few of the interesting points raised in Mr. Humphreys' *Selections from Dr. Farr's Writings on Vital Statistics:* but I hope that

these small instalments may be the means of inducing many of you to study this very interesting work, for it is an epitome of sanitary knowledge and research. And whilst it illustrates the genius of Dr. Farr it also serves to remind those who had the good fortune to be acquainted with him of the geniality of his temper and the charm of his conversation.

The Rev. CANON FLEMING (York) moved a vote of thanks to the lecturer for his valuable paper. In doing so he said that he believed that statistics had proved over and over again what the lecturer had told them that night—viz., that the transmission of those germs of evil by which they were surrounded was one of the great causes which lowered the national life, whether it be in health or in its moral tone, and therefore everything that could be done to get rid of those germs was in the direction of raising our national life.

Professor DE CHAUMONT (Southampton) seconded the resolution, and spoke eulogistically of the lecturer's life-long labours in the direction of sanitation.

The resolution was heartily adopted.

Sir SPENCER WELLS, Bart. (London), proposed a vote of thanks to the Chairman (the Dean of York), and said that the support of the Dean and clergy had been of the very greatest assistance to the York Congress.

Professor W. H. CORFIELD (London) seconded the motion, and it was carried with acclamation.

The DEAN OF YORK, in replying, said that the clergy might do a great deal of good amongst a large class of the people by endeavouring in a kindly manner to get them to attend to those sanitary precautions which were so commonly overlooked.

THE ARTISTIC SIDE OF SANITARY SCIENCE.

ADDRESS TO THE WORKING CLASSES.

By Edward Cookworthy Robins, F.S.A., F.R.I.B.A.

Sanitary science is but the knowledge of that which tends to the promotion of Health. The principles upon which such knowledge is founded are the same as those which form the bases of all the sciences, and result from the observation and study of natural laws. That the application of principles resulting from scientific research to the promotion of the Public Health has been the special duty and delight of the medical profession, goes without saying. Nevertheless, it is sometimes forgotten that this application takes a twofold form and purpose—viz., *Curative* and *Preventive.* The *former* takes disease as it finds it more or less developed, and strives to overcome its ravages, and to restore by healing arts the health which was lost. The *latter* takes health in its various phases, and strives to preserve it. In the former case the physician and the surgeon have to work comparatively unaided by other professional men outside their own body. In the latter case everyone can come to their assistance, and aid in the spread of the said principles and in the development of their practical application to the daily requirements of every living thing.

The Council of the Sanitary Institute of Great Britain is, for the most part, composed of gentlemen belonging to those professions which, more than any other, are concerned in this crusade against all forms of preventible disease—viz., Medical men, Civil Engineers, and Architects.

In the proper exercise of its functions, the Council has determined this year to give to each of these professions a representative voice, who shall speak to the artizans of York, in congress assembled, something more or less memorable from the triple points of view embraced by the three professions referred to.

The distinction between the medical profession and the other two is sufficiently obvious, but the difference between the engineer and the architect invites a few explanatory remarks. The title Civil Engineer is a modern one, and is distinct from that of military and naval. All three were originally comprised in the title, Architect—civil, military, and naval architects. Of late years the tendency has been to split up professional work into special branches, it having been found quite sufficient for most men to follow one branch in particular, and through the practice and special study of that branch to become acquainted with its every phase, thus fitting themselves to carry on scientific research therein, by which means the knowledge so acquired is duly classified and recorded for the benefit of succeeding practitioners and the public service.

Not only has civil engineering become a special profession, but it has itself been split up into various departments, only the select few—men like Stephenson and Brunel—practising in all the branches: thus there are civil and mechanical engineers, hydraulic and gas engineers, telegraphic and electric engineers, &c., &c., and, lastly, *Sanitary Engineers*, or men who have specially devoted themselves to the drainage and water supply of our towns and villages. Moreover, the engineer has mainly to do with public works of utility and convenience, either for Government, municipal bodies, or public companies, whereas the architect has chiefly to do with buildings; and although his constructive knowledge may be equal to that of the engineer, and be as necessary to him in the design and realization of such a building as St. Paul's Cathedral or the Houses of Parliament, yet there is a point of division which makes all the difference between them. The architect must not only be a builder, he must also be an *artist*. It is the artistic side of his profession which separates him from the engineer. He has not only to "build in truth," but he has also to "design with beauty."

In the few remarks that I shall have time to make this evening, I shall endeavour to quicken your interest in sanitary science from an *artistic* point of view.

I am quite aware that both engineers and architects have greatly interested themselves in sanitary appliances of houses, and that there exist at the present time specialists in both professions, whose practice is within the house as well as outside of it; but their work is chiefly required to overcome evils already existing, the deplorable extent of which is fully known only to those who have had special experience therein. But, broadly speaking, the engineer has to do with the public sewers and gas and water supply, while the architect has to devise the house drains and private gas and water supplies. Both are designers

only—their works are executed by contractors under their supervision, and in accordance with their plans and specifications. And even the contractor does not himself do the works, as a rule; he finds the men, the money, and materials, but the work is really done by men of the class which I am specially invited to address to-night, and whose presence here is the best evidence of their interest in the subject.

I can imagine some of you to say, What in the world can sanitary science have to do with artistic matters? Well, that is the question to which my remarks will be a reply, and I trust my answer will be sufficiently clear to commend itself to your judgment and to enlist your sympathy.

Primarily.—The non-adaptability of means to ends is not only unscientific, but it is eminently inartistic, nothing is beautiful that is not in harmony with its uses, or that is opposed to the first principles of natural science. Everything has an element of artistic completeness, which more or less answers the purposes for which it was designed. The fitness of things is in itself artistic; indeed, it is the only true foundation upon which to build up the accessories in form and colour which constitute the decorative aspect of those things of beauty which are "a joy for ever." There is a moral quality in all good and true work, a reasonableness in all honest labour, which, fully appreciated, brings its own reward. Perfectly to do anything is eminently artistic. It satisfies the moral and scientific aspirations of the individual and edifies others, and it is specially necessary to be done in hygienic operations.

The use of good materials and workmanship is therefore a fundamental characteristic of artistic sanitation.

The artistic workman has pride in his work, and does not do it only because he is to be paid for it; he has a taste for good materials, a love of good workmanship.

Such a man, having secured a site on gravel or chalk and perfectly free from obnoxious surroundings, studies the aspect and takes care that his rooms shall share in some part of the sunlight of the day.

If the substratum is insufficiently firm, he will make a concrete base for the walls to stand upon, mixed with river ballast and ground lime or cement, as the dry or wet soil may require; and not only so, but he will cover the whole area of the house with a layer of concrete 6 inches thick, and he will utilize this covering as a base for a cement, tile, or wood block flooring, by which the ground air and moisture will be excluded from the basement. This is better than constructing boarded floor on joists and sleeper piers, however well ventilated.

There are many ways of laying block floors, nearly every

system sets them in pitch on a dry prepared surface; some are dowelled together and screwed to plugs set in the concrete, some have dovetailed grooves at the bottom side, and the block is pressed into the asphaltum bedding; but all are required to be of thoroughly well-seasoned wood, and if of oak or pitch pine or other hard wood nothing is a better finish than wax-polish.

The artistic workman looks forward to be the purchaser, if he is not the builder, of his own house, and he recognizes the importance of preventing damp rising in the walls by the addition of a damp course built in at the level of the ground.

A single course of slates in cement is no use at all, but two courses of slates in cement laid between two courses of bricks in Portland cement answers very well. I have recently underpinned the whole of the walls of a large house, for the insertion of a layer of Hygeian Rock, in which case a single course of slates in cement of inferior quality had been laid, but the damp had risen in the walls some four or five feet in height by capillary attraction; so wet were the walls that the plaster was saturated, and had to be removed, and the walls covered with Portland cement. And this is not an uncommon thing. I have thus underpinned at least half a dozen houses for one client, the rents of which averaged £200 a year. In addition to this, I have had to put land drains, and to cover the earth with concrete, besides new drainage and new plumbing throughout, involving an average cost per house of £500.

The artistic workman of my imagination will have none of this to do in any house he buys or builds. He will see that there are damp areas as well as damp courses, and will suffer no soil to be banked against the house walls. Damp areas, half a brick thick, with half a brick space between them and the wall, are better than nothing, but they are not efficient protectors unless the walls are first rendered in Portland cement, and have a pure cement or tile water channel beneath, with outlets for the same to the drains, which, however, it is difficult to keep clear. I have had to remove a great many and to substitute open areas at least a foot wide below, and 18 inches above lined with cement, with pure cement semi-circular bottom, forming a rain water channel.

My own house is thus surrounded with open areas, provided with occasional Deane's trapped gratings for connection with the underground drains, laid straight to the man-holes which intercept them at all angles, the sewer side of the last man-hole having a syphon trap fixed.

The laying of such drains to proper falls in straight lines, embedded in concrete where under the house, with well-cemented joints, should be capable of resisting the water or smoke test without leaking; and this, with an inlet and outlet for ventilating

purposes, is an essential part of house sanitation artistically considered. Things out of sight are commonly out of mind, and are immorally executed with bad materials and workmanship.

The artistic workman will also be particular about his walls, he will avoid bond timber, which decays, and substitute galvanized iron hoop-bonding, tarred and sanded. He will insist on the footings of the wall spreading to twice the width of the wall over them, he will have the joints well flushed up and solidly compacted, well wetting his bricks in dry weather. He will build in English or Flemish bond, and he will not cut off the headers of the facing bricks and thus weaken the bond for falsely economical reasons. He will not consent to use porous bricks for facing because they are pretty in colour or texture. In like manner he will provide good mortar, he will object to road scrapings for sand, and will insist on clean sharp pit or river sand mixed in the right proportions. He will not sift the mould of the site, and think to evade the cost of good sand by using it instead, mixed perhaps with sea sand brought by the railway, to the curse of those who buy houses built with it.

I have just had to entirely strip off the cement stucco facing of a large house down to the bricks, and to re-cement the whole, owing to the bad quality of the cement and sand, and the defective mixing of the same.

The artistic workman of whom I speak will take care to construct his flues so as to avoid down draughts, which is quite a preventible disease in houses, if thought of in time. He will practically aid the Smoke Prevention Society by using stoves that will radiate heat and consume their own smoke at one and the same time, and be pretty to look at into the bargain. He will utilize the solid divisions between his flues, by building in Boyd's iron flue plates, and so gain an extract ventilating flue warmed by the ordinary smoke flues, and he will admit air at the side opposite the fire-place through a ventilator having an upward current capable of being closed at pleasure. He will not disregard the advantages of hollow walls, or an intervening vertical lining of Hygeian Rock asphalte, by which the walls of the house may be made entirely wind and waterproof.

The artistic workman will see that the Fir timber he uses is of well-seasoned Baltic growth. He will have sound Christianna deals for his joinery, and discard all miserable sappy, shaky, pithy stuff, that chips at every blow, and being unseasoned, shrinks and twists after fixing, causing gaps and cracks in doors and window frames, and letting in dust, and draught, and rain, while the sashes rattle in the wind. He will insist on having oak sills sunk and weathered and grooved for weather bars, and require thief proof sash fastenings, and brass axle pulleys in-

stead of iron, which rust and stick. He will want deep lower sash rails and high cill beads, so that he may raise the window for admitting air at the meeting rails of the rising sashes without making draughts; I doubt if he will have anything to do with casement sashes, if he can't afford Espagnoletti bolts for fastenings.

The artistic workman rejoices in broad eaves; he likes the shade and shelter that overhanging roofs afford, and he prefers the hard burnt Broseley tiles for a covering, because they look solid and strong, and are cool in summer and warm in winter, and he does not grudge stout timbers to carry the extra weight of them. If he lives in a town, he cheerfully obeys the provisions of the Building Act and the Sanitary Acts of Parliament prevailing, knowing very well that they are designed for the public weal to prevent the spread of fires, and to check preventible disease by sanitary precautions in which every one has a share in the profits arising from the healthiness of the neighbourhood resulting therefrom. If he does not use tiles, he prefers slate or lead to zinc, but if he should be obliged to resort to the cheaper material, he will only have the best and the thickest, laid with laps discarding the use of solder, so that it may adjust itself to the temperature, and he will only use cast iron eaves, gutters and stack pipes, galvanized or coated with Angus Smith's solution.

The artistic workman knows the value of good honest plumbing for the internal fittings of the house. He will have external soil pipes carried up to the roof for ventilation, and to prevent syphoning the traps. His waste waters and sinks and baths he will discharge over trapped gully gratings, to secure proper disconnection from the soil drains, and he will not have drinking water drawn from the W.C. water supply. He will cover his walls with non-poisonous paints and non-arsenical papers, which he also chooses of agreeable hues made washable, if not varnished. But he thinks it good economy to varnish both paint and paper throughout, and not only his walls, but also the borders of his floors: his carpets being always an easily removable square with border. He does not covet grandeur or gaudy colouring, but he loves good forms and outlines, and the soft harmony of secondary tints.

In short, our artistic workman is a remarkably sensible man, the excellence of whose materials and workmanship is visible at a glance. By their deeds such men are best known, and the moral quality of their labours is itself an æsthetic triumph of the most salutary description.

Secondarily.—The published papers of the conferences and lectures at the International Health Exhibition have put on

record an encyclopedia of knowledge upon sanitary science and its collateral branches, which will be of increasing value as it is read and studied by all interested in the subject, and to some of these subjects I shall now make reference. The arrangements which make healthy or unhealthy houses in town or country were well discussed and illustrated by Messrs. Eassie and Rogers Field, and are well worthy of study.

As secretary of the conference organised by the Royal Institute of British Architects, I read a paper on "Impermeable walls, floor and roof coverings," to which I must refer you for popular information on the exclusion of damp air, dry dust, and heat and cold from our dwellings.

Mr. Aitchison, one of the lecturers on architecture at the Royal Academy, discussed "the sanitary aspects of the inside fittings and decoration of dwelling houses."

Mr. White, previously known as the writer of papers on "Æsthetic sanitation" as applied to the humn figure, expounded "the hygienic value of colour in dwellings;" while Mr. Edis elsewhere discoursed on the sanitary principles which should govern the furnishing of dwelling houses. Thus, it will be seen that the artistic side of sanitary science has not been altogether overlooked by architectural writers, and is not so novel a subject as at first sight it may seem. Let us further consider the matter under the head of personal sanitation.

1.—Personal Sanitation.

The author of "Ethics of the Skin"—(another paper read at the "Healtheries") draws attention to the sevenfold functions of the skin.

1.—"It is a protection to the external surface of the body, and supports the internal organs. 2.—By means of the nerves it imparts to us sensation of touch, pressure, temperature, pain. 3.—It secretes oil. 4.—It is an organ of respiration supplementary to the lungs. 5.—It has powers of absorption. 6.—It acts as a purifier. 7.—By the aid of perspiration the heat of the body is regulated and retained at an equable temperature."

A.—*Personal Cleanliness.*

To enable the skin to exercise these various functions it is absolutely necessary it should be clean, and the morning bath is as essential to every part of the body as to the face. Fortunately fashion is on the side of right in this case, and nothing is more characteristic of good breeding than the performance of frequent ablutions. Lola Montes, the famous dancer, who cap-

tivated the foolish monarch of Bavaria, attributed the preservation of her beauty to her careful washing. It is said she bathed in milk and warm and cold water; and it is well known that the suppleness of the Indians and their silky skins are due not only to exercise, but to anointing their bodies with oil and frequent bathing.

Fashion is a capricious mistress, and her ways are not always so wise as in this instance—as when she decreed that powder should be applied to the cheeks from morning till night, "to the utter destruction of the complexion, which is sufficiently attested by thousands of skins," says our author, "puckered and pitted, which but for the use of powder would have remained to this day as soft as silk. As the powder dries up the moisture which the glands of perspiration in the face supply, more and more is secreted, till the glands become unable to fulfil their task, and shrinking, produce the little chasms that give the orange-rind appearance that is but too familiar to all observant people."

In a paper on "The Ethics of Art," I myself drew attention to a phase of art which is thus graphically referred to by the same writer:—"There has lately sprung up a taste in art that can only be postulated as a taste for disease—a leaning towards the outward expressions of decrepitude and decay. It is attempted to exhaust sentiment and beauty from the weariest phases of human wretchedness. In one school, at least, of this art movement, we find woebegone women, ill, limp and unwholesome. They look thin, weak and weary; their complexions are not those of health, and their attitudes are of a long-enduring debility. The men, too, are not more attractive in a sanitary sense; they look like an army of convalescents; they appear ill-fed and out of condition, and have the aspect of those that are in pain."

And thus it is that the common practice of darkening the eye socket, to increase the apparent size of the eye, is but a mimicry of the wasting in consumption. But beauty cannot grow out of deformity, nor thrive as the semblance of disease. The unfitness of the association is condemnatory of its artistic character. It is as inartistic as it is insanitary.

B.—*Physiological Considerations.*

Violations of physiological laws are the fruitful causes of unhealthful and of inartistic forms. I have no need to say much on this head: perhaps it is not so much ignorance as vanity that leads unthinking people into fashionable errors of this kind.

The author of "Æsthetical Sanitation" remarks that "the

bearing of health on true beauty, and of true beauty upon health, has not met with the recognition which, in these days of art and science, its investigation might be supposed to deserve. The injuries arising from ill-shaped, or tight, or high-heeled boots and shoes are very serious to the figure and gait, but still more so to the general health, through the manner in which the distortion of the foot, and of its position, acts upon the muscles of the hips and spine. But there is some hope to be derived from the popularity of the rational study and exercise of the body involved in the wonderful gymnastic system of which Colonel Ling, of the Grand Central Institution, Stockholm, was at once the author, exponent, and professor; by which system more than 500 muscles of the human frame, together with many thousands of nerves, are thoroughly and equally exercised and trained."

> "To trip it lightly as you go
> On the light fantastic toe,"

is a poetical fancy, a joy unknown to those who submit to their feet and ankles being distorted by this fashionable but inartistic folly.

Again, Sanitary Science and natural laws, and the highest embodiments of physical beauty of classic art, are at once ignored by the strange distortion of the body, and the extraordinary compression of the vitals, produced by the senseless and inartistic practice of "tight lacing."

But what can we expect uneducated people to do, when some would-be leaders not only of fashionable but of literary society, write as if it were a mark of distinction, an evidence of blue blood, to be possessed of a waspish waist. The lady's riding horse and the common dray-horse have been compared; and, in like manner, delicate women of refinement and grace are said to be gifted with this peculiar elegance, so called.

Well, granted that some women are weaker and smaller than others (for it is not exclusively the characteristic of the well-born), let it be remembered that, in so far as it is natural, it is in harmony with the whole frame of which it forms a part, and in such persons it is not the unsightly thing it becomes when the body is forced out of its natural harmony of form, into a shape which fashion dictates, and nature disallows and rebels against by insidious disease.

In Elizabethan times, as in our own, the natural form was completely transformed, and the beauty of classic models entirely ignored. But in these later times surely this fashionable tyranny is doomed to decay since the charms of the

Grecian examples have been pictorially represented and personally appropriated in the lovely Grecian dramas that have lately graced the stage under the guidance of Sir Frederick Leighton, and of Mr. Godwin, the architect.

The sculptors of Greece have never been surpassed; their system was peculiar to themselves and perfectly natural. They did not copy deformed or even ordinary persons, but made selections of finest examples of head, arms, legs and torso from several models, and so built up representative men and women, and held them up as standards of beauty for all to emulate. When Xeuxis sought to impersonate Helen of Troy, a city was ransacked for his models, and Edwin Long has immortalized the story by his wonderful pictures, now exhibiting in Bond Street, of the "Choice" and the "Selected Five."

The highest art is the healthiest—the noblest ideal the most salutary, morally and physically—let us not be behind the ancients in our power of realizing the truly artistic character of sanitary science.

C.—*Personal Attire.*

In my address delivered at the Sanitary Exhibition at Eastbourne, I remarked that, in the matter of *Dress*, sanitary science reveals to us that æstheticism in attire is not beautiful if it seeks to disguise or distort Nature's loveliness; if it is so disposed as to hinder the free exercise and healthful employment of every muscle and every limb; if it is so exacting that it impedes free breathing, walking, or running—whichever the sex. Skirts should be made the measure of the stride and length of the limb, and the grace of Grecian drapery should be as freely given to the waist as to the skirt.

No dress should touch the ground in walking—even ball dresses are curtailed now-a-days—and those which sweep the floor are only fit for the chambers of the upper ten. Yet one often sees working-girls' dresses trailing on the ground and raking up the dust and dirt and every abomination.

Dr. Jaeger's sanitary woollen system of clothing is destined to work a revolution in modern dress, and its economy is no less remarkable than its efficiency and healthfulness.

If it is essential to the grown person to be free from the trammels of dress, how much more necessary is it for the growing child; the stunted growth of childhood, bandaged up as children are in some countries, is the practical comment on the evil.

As I have said elsewhere, so common a thing as bandiness in children is preventible by good nursing. Is anything more brilliant than the beaming face of an infant when first it finds the use of

its legs and feet? How cruel to delay the process by which its nature teaches it to exercise its powers, by hindering its activity for fear of consequences, which can only occur by withholding the means of its enjoyment. Yet the labour of sustaining a child, and helping it by little and little to attain the coveted prize of its first ambition, is shirked by the mother or the careless nurse, till its unhealthy weight (the result of insufficient exercise) brings about a danger which need never have existed. The im portance of good nursing in early life is the first of sanitary revelations, and its effective realization the most lasting in its results.

"Scratch the green rind of the sapling or rudely twist it in the soil,
And the gnarled and crooked oak shall tell of thee for centuries to come."

2.—Relative Sanitation.

The limited time at my disposal requires great brevity in treating of the surroundings of the person: in short, the *Home*.

"That fair dwelling furnished wisely with a gentle tenant in it,
This is the glory of Humanity—thou hast seen it seldom."

A.—*Cleanliness of the House.*

In spite of the reputed slovenliness of artists, the studios of the period are models of elegance and cleanliness. The surface *cleanliness* of the house is as important to artistic completeness, as I have defined it, as personal cleanliness. Mr. Aitchison speaks well on this point: "The things we have mainly to guard against in our time are dirt, dust, and the fouling of the air; the street mud we bring in with us, consolidated external and internal soot and dust, and such soft matters that are occasionally dropped about, such as particles of food and the like. Every crack in the floor and skirting gets filled with this, and is liable to putrify when exposed to dust and warmth. Besides the dust in our streets, we make our own dust inside our houses; *particles* from shoes, from wood and stone, from our clothes, oil cloth, mats and carpets, are constantly being worn off and carried for a time in the air, together with the scales of our constantly renewing skin, and as soon as the morning air is overladen, or becomes comparatively still, every thing is covered with light dust, and a great deal of this dust is what the doctors call septic or putrifying dust."

Now all such open joints in wood-work, furniture, and plastering, should be puttied up, or filleted and painted, or var-

nished. All painting and papering can be made innocuous by a good coat of varnish. Smoothness of surface is a great help to cleanliness, and certainly as few ledges and holes for dust as possible, especially if out of reach; under-cut cornices, ornaments, and mouldings, tall bookcases, and cabinet tops are always covered with dust. Then as to woven things, whether of cotton, wool, or silk, the less there are of these the better, and wholly carpeted bedrooms are an abomination.

B.—*Surface Adornment.*

Artistic decoration is gratifying to the senses, and producing cheerfulness in the mind, sustains the body. Bare white-washed walls may be sanitary in a sense, but come very far short of our needs. The Hygienic value of colour is well worth the study, as Mr. White expresses it: "Colour is indispensable to man's happiness and well being, and the senses are as much affected by it as by light and warmth. It is a recognized pathological fact that colour of some sort is indispensable to the healthy condition of the eye, and that the condition of the brain is greatly dependent upon the healthy action of the nerves thus affected. The sensitiveness of the nerves to different colours is shared by the brute creation. By red, these nerves are excited; by green, in like manner, they may be soothed; or they may be rendered torpid by the presence of blue. Yellow, like light, is the colour which most strongly attracts the eye itself. We are affected by black and white in the same sort of way as by darkness and light. Light, in moderation, will produce alertness or wakefulness; in excess, it may produce restlessness or langour by weakening or dissipating the powers. Shade may induce a frame of mind favourable to attention, contemplation, and repose; in excess, it may induce melancholy and depression."

It is undeniable that the human system is thus affected by colour: an artistic side of sanitary science not commonly considered. It is obvious too that the aspect of the dwelling house has much to do with the suitability or otherwise of the colour employed in its decoration. Towards the cold and sunless north, the warmer tints, as red and yellow, must be resorted to. Towards the southern sun, we must oppose the cool shades of blue and grey; and towards the intermediate points of the compass, the greens and browns—the primary tints being sparingly used, and the secondary and tertiary shades being generally employed.

Finally, this is the sum of the matter—It is as inartistic as it is dishonest, insanitary, and false economy, to execute any works with bad materials and workmanship, but especially that of dwelling houses.

It is as inartistic as it is insanitary, to be dirty in our persons or in our dwellings.

It is as inartistic as it is insanitary, to be deformed in our figures, or surrounded by habitations doing violence to every law of geometrical precision and taste in outline and detail.

It is inartistic to be colourless in mind and body, or to be the centre of colourless rooms of furniture.

It is inartistic and insanitary to poison one's skin with cosmetics, or to cover one's walls with arsenical papers and poisonous pigments for painted and coloured decoration.

It is inartistic to dress chiefly for effect and not for useful life, or to clothe one's house with woollens and draperies and dust accumulators and other absorbents, to the prejudice of the purity of the atmosphere in which we live and breathe the largest portion of our lives.

It is as inhospitable as it is inartistic and insanitary, to invite one's friends to dine or to dance in a fœtid atmosphere, where no change of air is possible without draught; or to let your friends sleep in ill ventilated chambers, and perhaps unconsciously, but really (as did the Prince of Wales, at Scarbro'), inhale sewer gases arising from leaky joints of unventilated pipes laid in connection with public sewers.

I say it is as inhospitable as it is inartistic, and most culpably insanitary, to give your friends drinking water drawn from filthy cisterns over which miasma has floated and been absorbed, through the medium of standing wastes in direct untrapped connection with the sewer.

All these things and hundreds more are preventible causes of disease, and yet are commonly done and suffered by peer and peasant alike, through inattention to, or ignorance of, the simplest applications of sanitary science to the every day wants of life, or the absence of any attempt to realise the necessity for its introduction.

For the sake then of "sweetness and light," of "beauty and truth," of health and usefulness and consequent happiness, remember the *Artistic Side of Sanitary Science.*

THE STORY OF BREMONTIER,

And the Reclamation of the Sand-Wastes of Gascony

ADDRESS TO THE WORKING CLASSES.

By G. V. Poore, M.D.

In the short address which I have the honour to give to you this evening, I purpose to bring before you the chief facts of a great sanitary work which has been accomplished by our friends and neighbours, the French.

If you will take the map of France and look at that portion of the coast which skirts the Bay of Biscay, you will notice that two great rivers flow into the sea along this coast. One, the most northerly, is the Gironde, a stream which has upon its banks the great commercial City of Bordeaux; the other river is the Adour, the mouth of which is 150 miles south of the mouth of the Gironde.

Between the mouths of these two rivers the shore of the Bay of Biscay is formed absolutely and entirely of sand, and for a considerable distance inland from the coast the soil of France is composed of sand. It is to this great sandy district, covering nearly two millions and a half of acres, and known in France as the Landes or Moorlands, that I wish to direct your attention.

These Moorlands have been the despair of agriculturists for centuries, and have been universally regarded as among the dreariest and most unwholesome districts in Europe. Sand has not the reputation of being a very profitable soil to the agriculturist, and in addition to the natural poverty of the soil the farmer in this region has had to contend with the impossibility of efficient drainage. The Landes formerly produced nothing

except a scant herbage sufficient to support a few miserable sheep, tended by shepherds as ill-favored as their flocks, who generally suffered from one or other of the many diseases prevalent in the country; for disease was about the only crop which the Landes formerly brought forth abundantly.

Indeed, you will find that plains which are unproductive are generally unhealthy. The Campagna round Rome is a very hot bed of malarious and other diseases, and the sandy plains of Holland, and our own Lincolnshire enjoyed a similar evil repute, before efficient drainage was brought about by skilful engineers, and the cultivation of the soil became possible. Husbandry and disease are sworn foes, and the pursuit of agriculture is generally the pursuit of health, and a healthy man is generally contented. Here is an argument for "small holdings," for "three acres and a cow," and for "allotments," which I freely give to those who find pleasure in political contention.

The drainage of the Landes presented special difficulties, and difficulties which no engineering skill and no expenditure of money in the direction of bricks, mortar and machinery, seemed likely to overcome, and for the following reasons:

The reputation of the Bay of Biscay is familiar to every Englishman. It is there, if anywhere, that the force of wind asserts itself, and the winds are generally westerly in direction, and blow with fearful violence from the sea over the land.

The shore of that part of the bay with which I am dealing, is composed as I have said of unmitigated sand. The effect of the wind upon sand is familiar to all of us, for the sand is borne before the wind and travels considerable distances.

Now, in the Bay of Biscay the rise and fall of the tide is great, so that the sand washed up by the sea is left high and dry to the extent of many feet at low water.

Again, in the latitude of the Bay of Biscay the sun is far more powerful than here, so that in the interval between the times of high water the sand is greatly heated by the sun, and is so thoroughly dried that the particles no longer tend to stick together—glued by natural moisture,—but are easily driven before the furious blast which comes roaring from the sea. When the wind is not very strong it blows the sand into heaps along the shore. These heaps or hills may reach an elevation of from 60 to 300 feet, with an inclination of about 30 degrees towards the sea. These heaps of sand are called "dunes," a word having the same origin probably as the English "down," and formerly the whole fore-shore of the Bay of Biscay, between the Gironde and the Adour, presented an undulating appearance, as though a portion of the swelling, rolling sea had

been turned to sand and become stationary. If these sand-hills had been really stationary they would have formed a natural rampart against wind and waves, and it might have been possible to drain and cultivate the land behind them. But this was not the case. The scanty herbage of grass and reed which grew upon the dunes was not enough to fix them. It only required a gale of moderate force to completely alter the face of the country;—hills became flat, valleys were filled up, the lakes which formed behind the dunes became dry land, the water which the lakes contained was forced in some new direction, and what happened to the lakes also happened to the water courses, with the result that the whole country was water-logged, and fields and gardens which had been painfully and industriously cultivated were submerged by the drifting sand. It is even stated that villages disappeared completely in this way, and that the enterprising agriculturist in digging his estate was liable to the surprise of finding just beneath the surface the brazen weathercock on the steeple of some long forgotten parish church. It is a great labour, even at the present day, to keep the mouths of the Gironde and the Adour free from drifting sand, and it is certain that a century or so ago the course of the Adour was completely changed, owing to the channel getting dammed by sand blown into it. If an accident such as this could happen to a mighty stream like the Adour, one may judge of the great uncertainty which attended the course of smaller streams, and the absolute impossibility of draining the land.

A few feet below the average level of the surface of the district there is an impermeable stratum, locally known as *alios*, which keeps the water from flowing away, and beneath the impermeable stratum is more sand sodden with undrinkable water.

The result of this condition of things naturally was that the district of the Landes during the wet season was a swamp, and during the dry season a pestilential morass. The district was uncultivated, and produced nothing but scanty herbage, which served as pasture for a few wretched sheep, tended by shepherds doomed to spend their lives upon stilts, for the country was such that it was impossible to walk far in any one direction without sinking to the waist or shoulders. The country produced no corn and the population was the scantiest in proportion to acreage of any district in France. The population was kept down also by disease. Fevers of all kinds—and especially those of a malarious type—were exceedingly common. And in addition, there was a disease peculiar to this and a few other districts in Europe, known as Pellagra; a

terrible disease which disfigured and slowly killed; the patient dying with the aspect of a mummy and the mind of an imbecile.

The Landes had remained for centuries as a hideous blemish on the fair face of France, and all attempts to reclaim and cultivate them had signally failed. The Emperor Charlemagne, it is said, employed his troops in the intervals of his Spanish campaigns in an attempt to reclaim the Landes, but the forces of nature laughed at the puny opposition of the greatest magnate of the world, and at once resumed their sway as soon as the imperial soldiers had ceased to dig ditch and throw up bank.

I have no fear of being contradicted, when I say that it is of no use to attempt to fight with Nature. We may oppose her for a time, but only for a time. In the end she asserts her sway, and man sees too late how his labour has been in vain.

Dwellers in these Islands do not need to be reminded of the awful and irresistible power of wind and wave, against which the mere dead weight of cyclopean breakwaters, constructed at gigantic cost and maintained by constant periodic expenditure, is at times laughably impotent. I need not say that the wind and waves of the Bay of Biscay are the roughest and rudest in the world, and that if the maintenance of dead breakwaters is an endless and almost hopeless task on our coasts, on the stretch of coast which I am considering their construction and maintenance would be alike impossible. Thus it was that until the latter end of the last century the condition of the Landes, a tract of two millions and a half of acres, seemed hopeless, and they seemed doomed to be open to the fury of sand storms for ever, and to remain a pestilential, unprofitable, undrained swamp to all eternity.

But, happily for France and especially for the dwellers between the Gironde and the Adour, there was born in 1738 Nicolas Theodore (or Thomas ?) Bremontier. It is said that the world knows nothing of its greatest men. Certain it is that Bremontier was one of the greatest benefactors to humanity that the world has ever known, but I regret to say that I can tell you very little about his life.*

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* By the kindness of Mr. Jenkins, the Secretary of the Royal Agricultural Society, I have been enabled to obtain from Paris the following extract from the memoirs of the Agricultural Society of the Seine. This short biographical notice of Bremontier is from the 13th volume of the Transactions of the Society (for the year 1810), and has been most courteously extracted by M. Laverriere, the Librarian:

"Nicolas Thomas Bremontier was born at Quavilly, near Rouen, July 30th, 1738, and soon manifested great aptitude for the exact sciences. He was very young when he entered the school of the '*Ponts et Chaussées*,' and at 18 he went to the College of the Marine Artillery at Toulon, to teach applied mathematics. This school, established by M. Choiseul, was broken up a few years later, and Bremontier went as Engineer of Roads and Bridges, first to

Bremontier recognised the fact that the only way to grapple with the forces of Nature is, not to fight blindly with them, but to try to make use of them. Nature is always working for our benefit, and although it seems as though at times in a fit of anger as it were (the real object of which we may fail to comprehend) she destroys much of her own work, still, in the long run, those who endeavour to turn the forces of Nature to account will find the balance enormously in their favour.

It is well known, and has been long recognised, that the best protection for a bank or rampart against the fury of the elements is to plant it. A loose heap of earth is liable (no matter how huge it may be) to be washed and blown away in times of tempest. If, however, the bank be planted, the roots of the trees and plants hold the elements of the soil together, and the spreading branches and leaves form at the same time a protection from the fury of wind and water. It is true that even planted hills and banks may suffer severely in times of exceptional storm, but the storm once past, the

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Perigueux, and then to Bordeaux. Here he was actively engaged in his profession, and published papers on the drainage of marshes in the neighbourhood of Bordeaux, on the cleansing of the Bordeaux harbour, and on the methods of restraining rivers and torrents to their proper beds. His energy was inexhaustible, and in his leisure he taught himself the principles of music and became in this direction most efficient. Promoted to be Inspector of Roads and Bridges, he went to Brittany to make a canal to join the Rance to the Villaine. Thence he was sent to Normandy to make a canal from the Orne, by Caen, to the sea. At Caen, he reconciled the differences which had arisen between the provincial magnates and the officers of the Ponts et Chaussées, and his judgment and conciliatory spirit had proved useful in a similar way in Bordeaux. When, therefore, the post of Engineer in Chief for Guienne became vacant, he was appointed in obedience to the wishes of the locality.

"Bremontier joyfully accepted this post, not merely because it was at once a professional and social promotion, but mainly because while formerly living at Bordeaux he had been a witness of great troubles for which he believed he had found a remedy; at least his early experiments (conducted at his own cost) gave him a strong cause for hope. Bremontier felt that here was to be the theatre of his greatest and most useful labours. Possibly, we might believe, he thought to earn an unperishable fame, for self-interest, we are prone to think, is the main spring of good works. Bremontier had less need of such a spur than most men.

"He had visited the sand hills of Gascony during his first sojourn at Bordeaux, and bewailed the misery caused by those moving mountains thrown up by the sea and driven by the west wind, which had already smothered a vast tract of cultivated land, as well as rural inhabitants and villagers, and threatened to cover the more fertile districts and advance even to Bordeaux itself.

"The idea of arresting this devastating power took possession of Bremontier, and the hope of success occupied entirely his brain and hands. He studied the nature and the movements of the sand, he measured their extent, and noted the ravages past and to come.

"He recognised their vegetative power, and from the year 1787, he knew that a great number of plants and especially resinous trees could find nourishment in them. He made experiments at his own cost to get some definite

silent forces of nature commence at once the work of reconstruction; the damaged roots send forth fresh rootlets, the damaged branches soon push again with buds of promise, and possibly before the advent of the next exceptional gale, the storm rampart is stronger than before. These silent forces of nature are truly beneficent; they merely ask for fair play, they work for us without wage, and one great principle of success in all work in this world, be it legislative, be it sanitary, or be it of any other kind, is to go with them, not to fight against them; to learn if we can what is nature's inexorable law, and lay to our hearts the fact that nature brooks neither stubbornness nor disobedience.

Bremontier recognised the fact that the only way to fix the drifting sand-dunes was to plant them: but how and with what? These were the questions he had to solve. Sand is not regarded as a promising soil by agriculturists in general, and the sea-sand along the shore the least promising of all. And yet sand must contain in its interstices a good deal of organic matter left by the seaward-tending rivers, and the fact that the sandy estuaries

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facts. He perfected his method of procedure, and at last, certain of success and feeling that such an enterprise was beyond the power of a single man, he sought the help and succour of the Government. His assertions were not credited, and his project shared the fate of many other creations of genius which are repelled at their birth by the ignorant, until the results become so numerous and evident as no longer to be neglected.

"After Bremontier's first attempt the solid basis of procedure was found, and the extension of his work alone was necessary. What proportion was there between the few acres planted at the cost and by the care of one man, and that vast stretch of country extending from the Gironde to the Adour, nearly 180 miles and averaging 3 or 4 in breadth, all exposed to the action of the destructive sand and in part covered by it?

"During his second residence at Bordeaux he renewed his application to Government, this time still more certain of the success of his project.

"In a short notice like this it is not possible to enter into all his trials and difficulties, nor to dilate upon the dangers to which he and his works were alike exposed during the period of anarchy to which France at that time was so long a prey.

"The genius who then controlled the destinies of the Empire appreciated the value of Bremontier's projects, and in the year 1801, he allotted 50,000 francs for the continuance of the work, and a similar sum has been allotted to it in each succeeding year.

"Bremontier now began to enjoy the fruits of his labour, and in 1808, 3,700 hectares of land (about 9,000 acres) had already been sown. Honoured by the esteem of the department of *Ponts et Chaussées*, he had been promoted to the rank of Inspector-General, and he was chosen by his fellow citizens of Bordeaux to be one of a deputation to wait upon the Emperor at Bayonne. He had then the happiness to submit to this great ruler his future projects and his past success, and felt assured that from that time the great work to which he had devoted himself would not be abandoned, and that its future success was assured. The fixation of the whole of the Dunes is now ranked among the great public benefits to which Napoleon with the instinct of a genius gave his support. Bremontier in his dying hours was doubtless consoled by this pleasing prospect, and he breathed his last surrounded by his friends, and with the calmness and resignation of a true philosopher."

of rivers are very liable to breed malaria may be taken as evidence that organic matter must exist in quantity and in fine division among the minute particles of sand. This spring I was astonished at finding, close to Biarritz and within a few yards of the sea, a very flourishing crop of peas which had been sown in the sand without, apparently, the admixture of any manurial body. They were protected from the sea-winds by hurdling made of gorse, and enjoyed an ample exposure to the sun, and thus bid fair to yield a good return in due time. The pea is a plant that sends its roots very deeply, and the roots doubtless found moisture and nourishment at a great depth below the surface. For fixing dunes, however, something more permanent than peas is necessary, and Bremontier resolved to try the Pinus Maritima, a species of pine-tree which was known to flourish in sandy soils near the coast. The Pinus Maritima is a species of Pinaster, and in habit and size it very much resembles the common "Scotch Fir," with which you are all familiar. Bremontier made his first sowings of the seeds of Pinus Maritima in the year 1789, and I will state shortly his perfected manner of procedure by which he overcame the obvious difficulties of his task.

I wonder what the dull-minded and prejudiced peasant thought of this enthusiast who went forth to do battle with the mighty ocean and still mightier wind, armed only with a few handfuls of pine seeds such as might be driven far away by the first strong gust that blew. I wonder also if only the ignorant laughed at him, and if he escaped the jeers and sneers of those who had enjoyed the advantages of a better education. Probably not, and equally probably he cared little for the opinions of the prejudiced. The pine seeds were sown mixed with seeds of the common broom, and the sowings were made in a direction at right angles to the prevailing wind. A screen of hurdles made of gorse or of planks deeply driven into the sand was placed on the windward side of the seed-ground, and the seed-ground itself was thatched with pine branches and other suitable material. At the end of the first year the broom would be 9 or 10 inches high and the pine saplings only 2 or 3 inches, and thus the tender little saplings were nursed and protected by the plants of broom. In half-a-dozen years or so the brooms had reached their full growth, but the pines continued to grow, and, in course of time, overtopping the brooms smothered their nurses, and being themselves judiciously thinned and pruned by the foresters, grew into fine trees able to resist the fury of the elements, sending their long tap-roots and laterals in all directions through the dunes, and causing them to become year by year a stronger and stronger protection to the inland wastes instead of a dangerous menace. Before

the dawn of the present century Bremontier had proved the success of his practice, and in the year 1801 the matter was taken in hand by the French Government, and in 1810 it was ordained that so much of the sand-dunes as belonged to the State should be planted after the manner of Bremontier, while the private property of those who were unwilling or unable to plant should be taken in hand by the State, all revenue arising from such land being confiscated until the cost entailed by the work had been recouped.

In 1817, a yearly sum of less than £4,000 was voted for the reclamation of the dunes and wastes of Gascony, the result of this has been that in the department of Landes, 98,000 acres of forest have been planted, and that whereas in 1834 there were about 900,000 acres of uncultivable land in the department of Landes alone, there are now only 340,000 acres, showing that in the past half century, reclamation has proceeded at the rate of 12,000 acres a year. These figures apply only to the department of the "Landes," and leave out of consideration the department of "la Gironde," in which, however, nearly half these waste Moorlands are situated. This reclamation has been made possible by the fixation of the dunes, which has rendered systematic drainage operations practicable; canals and drains have been cut in every direction, and, thanks to the pine forests, there is now no longer any risk of their being choked up with sand.

The Pinus Maritima has proved a very profitable tree, and within twenty or twenty-five years of sowing, it began to yield a return. The timber is of very moderate quality, but is largely used for packing cases, as shores in the dockyards of Bordeaux, for railway sleepers, and for fire-wood. I may remark in passing, that the great scarcity of coal in France compels the French to look to their forests for fuel, and there is probably no nation more clever and more thrifty in the management of trees.

The pine trees are chiefly valuable for their yield of turpentine and resin, which in that comparatively warm climate is very abundant. The resin is obtained by removing a strip of bark from the tree and allowing the exuding sap to trickle into a small earthen vessel shaped like a flower-pot. The trees begin to yield resin when they are about twenty years old, and the resin is worth about £5 a hogshead in its raw crude condition. As far as I am able to judge, it requires about 250 trees on an acre of ground to give a hogshead of resin. It requires comparatively little labour to collect the resin, so that the profit per acre from the resin harvest is considerable. It is said that the draining away of the resin does not seriously

affect the value of the timber. Besides resin and timber, the manufacture of charcoal is largely carried on, charcoal, as you are aware, being in great demand in France for a variety of purposes.

Thus it appears that the waste moorlands on the shores of the Bay of Biscay have become of great commercial value. Journeying from Bordeaux to Bayonne the railway passes through one long monotonous pine forest. When I state that the journey takes between four and five hours you will be able to judge of the vast tract of country which, once the abomination of desolations, is now covered with millions of the resin yielding Pinus Maritima. The cultivation of the pine improves the soil, which is gradually enriched and altered in quality by the dead leaves and other vegetable *debris* which fall upon it. In some places clearings have been made in the forest and vineyards planted, and I need not remind you that the most valuable vineyards in the world are on the southern bank of the Gironde on the very fringe of the pine woods which I have been describing.

The rise in agricultural value of this tract of country, great as it is, is a small matter. The great gain after all has been the rendering wholesome of a pestilential swamp and the removal of a plague spot from the face of Nature. The Shepherds of the Landes, except in very few places, have now no longer any need to walk about on stilts, and Malaria and Pellagra from being common have become rarities, and will soon become extinct. Life in this district no longer languishes and ends prematurely, but the dwellers of this vast district enjoy a vigorous health, and that happiness and contentment which vigorous health alone can give.

Population has increased very rapidly since the beginning of the century, and industries of various kinds are able to be carried on. Round the basin of Arcachon is a very large population supported mainly by the oyster fisheries, and the town of Arcachon which has grown up in the pine forest is one of the best known health resorts in Europe, where land in the best situations is worth about £1,000 an acre. Well may the dwellers in Arcachon raise a statue to Bremontier, whose far-seeing and thrifty policy has brought them health, happiness and riches in place of disease, misery and poverty.

I have now given you the simple details of the manner in which Bremontier's small beginning has made great end; how his pine plantation, made at first with no little labour and sorrow, began along the coast, and with the lapse of a century has reclaimed a province.

You will be asking, perhaps, why I have chosen this subject

for my short address to the inhabitants of York, and having listened to my tale, you will be asking for the moral.

I chose this subject for my address for several reasons. The chief reason probably is to be found in the fact that I spent part of the early spring of this year in the district which I have been describing, and what I saw there made, as it could not help doing, a very deep impression upon me.

My next reason was that it is an aspect of sanitation which is not often dealt with at meetings like this, and I was glad of the opportunity of taking you away from pipes, traps, sinks, and those expensive roads to health which we have to consider in cities, to contemplate the sanitary effect of good husbandry in the open-air; and to show you on a large scale what I believe to be universally true, viz., that the cultivator of the soil must always be the right-hand man of the sanitarian.

It has been refreshing for us to contemplate a sanitary work which has been a financial success. Sanitation always gives us the best of all dividends—health. And it is a short-sighted policy, especially in cities, to look for a money return on the capital expended on works for improving the public health. The thrifty French, however, have given to the world a valuable example of a comparatively small expenditure yielding *in the course of time* a magnificent return of both health and material prosperity.

Do not run away with the idea that the Pinus Maritima is a cure for all waste lands, and unwholesome districts, because it happens to be especially suited for the soil and climate of the eastern shores of the Bay of Biscay. In the warm climate of the south it yields abundance of resin and turpentine, grows quickly, and furnishes a large quantity of timber. In more northern climates it will grow, but does not flourish; and although there is at least one fine specimen in Kew Gardens, it is not, from all I have heard, a tree suited to this climate.

My story seems to show that in the reclamation of waste lands we must not be in a hurry. Nature is sure, but from our point of view, slow. Bremontier, and those who worked with him, began in a small way. We may be sure that experience had to be bought at more or less expense, and it was not until the success of his methods had been proved that the French Government seriously took the matter in hand. Bremontier was a true patriot. He worked solely for the good of his country and for posterity. He had no idea of immediate profit, either for himself or his contemporaries. He drew his modest salary as inspector general of roads and bridges (for he was an official of the state department of "*Ponts et Chaussées*), but looked to no further profit. He lived barely long enough to see

the resin flow from his first plantings. He pointed out, as it were, the way to the promised land, but, for himself, he only saw the promised land " in his mind's eye." It is good for us to bear this fact in mind, for many reformers of the present day seem, in questions of land management, to look only for immediate results, and to be actuated by the not very noble sentiment of " bother posterity, what has posterity done for me ? "

There has been a good deal of talk of late about the reclamation of waste lands in this country, and the opinion of some seems to be that worthless soil presents a glorious opportunity of wasting money. These are questions concerning which I cannot speak to you as an expert, but it seems certain that the problem of reclamation must differ with the circumstances of soil and situation, and that it is far more easy to do the wrong thing than the right. The first thing necessary is to find a Bremontier to show the way. We shall want a Bremontier to show us the way out of the pestilential quagmire which we Londoners are making by dint of large expenditure in the estuary of the Thames. We want a genius and enthusiast who will do for the bogs of Ireland what this great Frenchman did for the Landes of Gascony.*

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* For many of the facts embodied in this address I am indebted to Dr. John Croumbie Brown's " Pine Plantations on the Sand-wastes of France." Edinburgh (Oliver and Boyd, 1878).

THE SUPPLY OF WATER TO TOWNS.

ADDRESS TO WORKING CLASSES.

By James Mansergh,

MEMBER OF COUNCIL OF THE INSTITUTION OF CIVIL ENGINEERS.

I propose to devote the time allotted to me this evening to the subject of water supply generally, illustrating my remarks by a short description of the works furnishing water to the inhabitants of this City of York.

When I was a boy my ideas with regard to the sources of water for domestic use were naturally derived from the experience of those early days.

In the yard adjoining my father's house was a pump, and I was told that it stood over a well which had been dug into the ground to a certain depth at which water was found.

All our neighbours in the town obtained their water by a similar contrivance, and when I went a little way into the country I found there were wells open to the surface without pumps, and from which the water was drawn up in a bucket by means of a rope. I could see the water when I looked down the well. No further explanation being forthcoming, I naturally concluded that below ground there was universally distributed a store of water, into which it was only necessary to sink a well and lower a bucket to obtain as much as was wanted.

I have reason to believe that in those days my conceptions of the underground reservoir were shared by many of my elders and betters, and, as it may be that some now before me have even now no very clear notions on the subject, I will try and throw some light upon it.

It is estimated that about five-sevenths of the whole area of the earth's surface is covered with water, either the salt water of the oceans and seas, or the fresh water of inland lakes.

Now from this enormous area of something like 145,000,000 square miles, the sun is always drawing up the water in the shape of invisible vapour into the atmosphere by the process of

evaporation, and the air in this country usually contains about $1\frac{1}{2}$ per cent. of this aqueous vapour.

The warmer the air the more capable is it of absorbing and holding moisture, and the greater the quantity held the lighter becomes the air. From water surfaces the amount of evaporation is on the average about equal to the rainfall; in cold climates it is probably somewhat less, and in hot climates somewhat more.

The Dead Sea in Palestine has no known outlet, yet the waters of the River Jordan are constantly pouring into it without raising its level, which is 1,300 feet below the Mediterranean. What the river pours in the sun regularly pumps out.

Again, the Mediterranean itself is another notable example of the enormous quantities of water constantly being taken up into the air, for notwithstanding the volumes delivered into it and the inland seas connected with it by the larger rivers, such as the Rhone, the Po, the Danube, the Dnieper, the Don, and the Nile, this is insufficient to make up for the evaporation, as it is found that almost at all times the current is setting inwards from the Atlantic through the Straits of Gibraltar.

From the land moistened by rain evaporation also goes on, until after a season of drought there is practically nothing more to take up, and its amount varies very much according to the character and configuration of the surface.

Now let us see what becomes of all this water so taken up into the air. A quite familiar illustration will suffice to tell us. Suppose you are sitting in a warm room on a winter's night with lights burning, the air will from several sources become charged with moisture, in the same way as is that passing over the sun-warmed surface of the ocean. The glass of the windows is kept cool by contact with the cold air outside, and you will find that inside it is covered with a thick misty film, forming possibly in places into decided streams running down to the frame. This, as you are all aware, is the result of condensation. The warm air of the room in circulating about comes against the cold glass, is cooled, and thus made incapable of holding as much moisture as before, and therefore deposits it upon the window.

This is just what happens when warm saturated air meets with a current of cooler air, as frequently occurs when warm winds, blowing across the sea, touch the land. The invisible aqueous vapour is first condensed into mist, forming clouds, and when still further chilled aggregates into drops and falls to the ground in the shape of rain, and under suitable conditions as snow or hail.

In this country the prevailing wind is from the south-west, and brings the moisture-charged air from the Atlantic. It is

not surprising, therefore, that on the west and south coasts there is more rain on the average of years than on the east. My friend Mr. Symons has shown this very clearly on what he calls a Hyetographical Map, a copy of which he has been good enough to allow me to show you.

Those parts of the country where it has been found from long series of observations that the least rain falls, are coloured a very light blue. This is, broadly speaking, along the east coast, and forms a zone in which the average annual rainfall is less than 25 inches. Then another zone in which it ranges between 25 and 30 inches, is coloured a slightly darker blue. Between 30 and 40 darker still, and so on in succession until the heaviest falls are reached near the coasts of Wales, Cumberland, and the West of Scotland, being over 75 inches.

Where the land is the highest the rainfall is the greatest; this is natural, because the mountains rear their cold heads up into the air and act as condensers. The darkest coloured spots are therefore in Cumberland and North Wales. Some of you may possibly have noticed in this country with what persistence a cloud sometimes seems to hang about at the top of a mountain you have wanted to ascend. On the isolated elevated peaks of the Alps, even when the wind may be blowing strongly, this is often seen in a peculiarly interesting shape. The sky all around may be bright and clear, excepting just on the lee side of such a peak, where a little cloud may be seen apparently attached like a fluttering grey flag. The wind brings up the warm moist air; immediately it touches the chill summit the moisture is condensed, and passes on some little distance to leeward as visible vapour, but is soon re-absorbed and lost to view, as it gets beyond the influence of the condenser. This is therefore not a stationary cloud, but one which is constantly being formed and as constantly being destroyed. The wind keeps bringing up the moisture-charged, but invisible air, and the mountain top condenses it temporarily in passing. In these cases the condensation is only carried to the extent of creating mist or fog.

On a summer evening you often see mist apparently rising from the surface of low-lying land; this is really only due to the condensation of the vapour in the warm air by the cooling ground.

The dew upon the grass, the moisture upon your window, the cloud upon the mountain-top, and the showers which water the earth, are all the results of condensation, and condensation is due to differences of temperature.

Many years ago on a voyage to Brazil in the old "Great Western" we stopped to coal at St. Vincent, one of the Cape de Verde Islands, a bare sand rock, with scarcely a trace of vegetation, and we were told that they had not had a drop of rain

for over a year. This pitiable condition was due I presume to the fact that the island had, during that period, never got sufficiently cool to act as a condenser.

Now let us see what becomes of the rain after it has fallen upon those parts of the earth—for example, our own island—which are fortunate enough to get it in sufficient quantity, and with fair regularity. This depends—as by a moment's consideration you will realise—upon the nature, shape, and material, of the surface upon which it falls. If upon the steep slated roof of a house it runs rapidly down to the eaves' gutters, and from them by the downspouts more rapidly still to the ground, or the drains. Thence it passes into a stream or river, and so on ultimately to the ocean, whence it came. When the rain ceases the roof soon dries, because there are no hollow places where the water can lodge, and there is no percolation through the slates into the house. The rain that falls upon a paved street does not get away so rapidly as from the roof. First, because it is not so steep, and second, because there are slight hollows at the joints and other places where the water lodges and remains. Most of it runs off by the gutters, but some of it is evaporated and some of it may sink into the ground.

In these two cases the behaviour of the rain depends principally upon the artificial circumstances of the surfaces, and examples might be multiplied of many various divergencies from simple natural conditions; but it is not necessary that I should particularise them, and I will pass on to consider what happens in open country.

A few examples will suffice to mark the differences.

Take first such a district as that popularly known as "the Lakes" in Cumberland and Westmoreland. There the hills are formed in great part of hard unfissured rock, into which the rain cannot percolate, principally because of its density, and partly because the slopes are steep and the water runs off rapidly into the watercourses and rivers and on to the sea without much appreciable diminution in volume. Some loss of course there is by evaporation. If the rocks were absolutely bare, quite impervious, and as steep as a house roof, it would of course be very small indeed, but this is rarely the case. More frequently a great part of the surface is covered with either a thin layer of disintegrated rock or gravel into which some of the rain percolates, or with turf or other vegetable growth which absorbs part and holds another part until it is evaporated. It has been estimated that from such a district from 7 to 10 inches of the annual rainfall is thus accounted for, which would be about one-eighth of the average annual fall.

It is interesting to point out here that such a map as Mr.

Symons, before referred to, is almost certain to indicate at a glance two things in addition to what it actually professes to show; that is to say, wherever you notice the darkest blue patches you may rightly conclude, 1st, that they mark lands of high elevation; and, 2nd, that these lands consist of rocks which have maintained their altitude because of their hardness and power of resisting the wearing down, or, as geologists call it, the degrading influences of air and wind, rain and frost.

Now compare this lake country with the chalk downs of the south of England. In many places these are fairly steep, and the water would pass off quickly, but for the extreme porosity or easy permeability of the subsoil. Generally the downs are covered by only two or three inches of soil and fine grassed turf offering a slight obstacle to the free percolation of the rain into the chalk below; and, as a matter of fact, there are no surface streams in the higher parts of a chalk country.

As in the former case, absorption by and evaporation from the vegetable covering take place, and water held by capillary attraction in the upper part of the subsoil is also drawn up by the sun and air and evaporated; but there is here the essential difference that a large percentage of the rainfall passes away out of sight into the ground, part of which is absorbed into the mass of the chalk, and the rest runs through fissures and among flint veins to some natural or artificial outlet at a lower level. On the south coast the water may be seen running out of the base of the chalk cliffs and meandering through the shingle beach to the sea. Inland it appears in the shape of strong springs, as at Croydon and Carshalton, where they go to form the river Wandle, a short tributary falling into the Thames at Wandsworth.

In the London basin a good deal of the rain falling upon the chalk-outcrops to the north and south, passes under the tertiaries, and is recovered by means of wells sunk through the impervious overlying beds and pumped up for domestic and trade purposes.

In the case of my native town above referred to, the circumstances were these. The upper strata for 10 to 20 feet in depth consisted of porous sand or gravel, into which the rain percolated until it was stopped by a bed of impervious clay upon which the gravel rested. This formed the bottom of an underground reservoir, and if a well were sunk down to the clay and lined with open jointed brickwork or rubble, the water soaked through from the gravel, and could be obtained by means of the pump. It is evident however that this reservoir could not be inexhaustible. Such a store is merely a bank. If a man puts £100 into his credit, he can at his convenience draw

out ten instalments of £10 each, but he cannot draw more without again replenishing his credit.

This case of my own youthful experience, so far as it was utilized, was one of the simplest that can occur. The wells were all shallow, the clay-bed was for all practical purposes the bottom of the reservoir and the quantity of water it would hold was strictly limited, and each well only lasted out a few months in time of drought. Under other geological conditions the quantity of water yielded by a well may be increased by deepening it, as would be the case in the water-bearing part of the chalk by enlarging the area from which the water would be drawn; for the well must be regarded as the apex of an inverted cone, towards which, when pumping is going on, the water gravitates as it were down its sloping sides. The lower, therefore, the well is sunk the larger will become the cone which can be exhausted by pumping. Or a well may be made more productive in a district consisting of interstratified beds of pervious and impervious material by sinking through one of the impervious beds which for the time being has formed the bottom of the well into a pervious or water-carrying bed below, this bed having in one direction or other an outcrop exposed to the surface where the rain can fall upon and charge it. Varied, however, much as the conditions may be in different localities the fact remains that the quantity of water obtainable from underground sources depends entirely upon the amount of rain which gets into them. Thus, if it were to happen here as it does in the island I have mentioned, that it did not rain at all for a whole year, probably every one of the hundreds of wells drawing water from the chalk in London would be exhausted.

Referring again to the old pump at home, I need hardly say that it has long since been abolished with all its fellows and replaced by a public supply distributed by pipes under pressure, such as now exists in the great majority of the towns of this country. This change has come about partly on account of the great convenience of the modern system, but principally because of the evils resulting from the old state of things.

Thus within a few yards of our family pump was also the family privy, and when in later years I began to realise the fact that between the privy pit and the well, there was the freest intercommunication through the open gravelly subsoil, my sensations were not of the pleasantest. Now-a-days it makes me shudder to think of the abominable conditions under which the whole community was living, and I can understand why the death-rate at that time was over 30 in a thousand. The town was not a large one, but I now know that from 150 to 200 persons died every year on account of this charmingly simple circulating

system of sewage disposal and water-supply. The fittest only urvived the treatment.

The reform that took place in my native town thirty years ago has been repeated in hundreds of others, but the sort of works has had to be varied in each case according to the local topographical and geological conditions of its neighbourhood. I will refer shortly to a few of these different types.

First, however, it must be understood that in any public system of supply, where the water has to be conducted through many miles of street mains and house service pipes, it is necessary that there should be some initial propelling force to overcome the friction, and to raise the water to the varying levels of the district and to the upper floors of houses. This pressure is usually obtained by commencing the main distributing pipe in a reservoir placed at a sufficient altitude, or, in exceptional cases, in pumping continuously into the mains by means of steam or other machinery.

The reservoir is the preferable and almost universal arrangement, as it not only furnishes the pressure, but it provides a store or reserve of two or three days' consumption as a safeguard against accidental interferences with the means of supply beyond itself, and it is called the service reservoir, because whatever may be the original source from which the water is obtained, it must first be delivered into this reservoir before it can be "served out" or distributed to consumers in the town.

There are two great divisions under which all sources of water supply may be classed, viz:—"above-ground" and "under-ground" sources. We have already seen that of the rain falling upon the earth, one part is re-evaporated; a second part runs over the surface, forming streams, rivers, and lakes; and a third part percolates below the surface into the ground, either where its mass is pervious, or by way of interstices, or open cracks and fissures.

The second part replenishes above-ground sources, and the third part under-ground sources.

Some towns are so situated that the water for their supply can be taken from above ground, that is from a river or natural lake, within a reasonable distance, and at a sufficient altitude to flow by gravitation into their service reservoirs. Other towns may be so located that water can be obtained also by gravitation, but where it may be necessary to collect the water from a given watershed or drainage area into reservoirs artificially constructed to contain it; because, first, no natural lakes exist; and, second, though there may be small rivers or streams they are not large enough in dry summer weather to furnish the quantity the towns may require.

These are called storage or impounding reservoirs, and they have been constructed in large numbers by damming up the valleys on both sides of the Pennine range of hills, for the supply of water to the manufacturing towns of Lancashire and the West Riding of Yorkshire.

Again, towns situated like York, upon such a river as the Ouse, but not much above sea level, can obtain an ample supply without the necessity of making storage reservoirs—because the river is large enough at all times to meet the demand upon it; but to set against this they have to incur the cost of pumping the water up into the service reservoirs, in order to provide the necessary pressure for distributing purposes. It will thus be seen that "above-ground" or surface water supplies are again sub-divided into what are known as "gravitation" and "pumping" works.

Under-ground water, on the other hand, almost universally requires pumping works. There are a few cases in which water, after passing for a distance under-ground, reappears in the shape of springs at a sufficient elevation to supply the service reservoirs of some fortunate towns, but as a rule under-ground water has to be recovered by the sinking of wells and the use of pumping machinery. In this country the chalk and the new red sandstone are the largest sources of under-ground water supplies, but there are also many wells in the oolites, mountain limestone, and other water-bearing strata.

Now let us say a few words on the different qualities of water, for you are all aware that waters may differ in various ways, as much as many manufactured articles. During the first stages of its formation, viz., evaporation and condensation, all water is practically alike pure; but even whilst still in the air, and before it has reached the ground in the shape of rain and snow, its quality is affected by dust and smoke, which you can easily see, and by the more finely divided particles always floating about in the atmosphere, but which you cannot see, excepting in a bright beam of light in an otherwise darkened room. A striking illustration of the relative deterioration which takes place by mere contact with the air in different situations is to be found in snow. In the middle of a large town its virgin purity of whiteness is dimmed in a few hours, but out on the open mountains it is retained for days unimpaired, simply because the air is cleaner in the one place than in the other.

By flowing over the surface of the ground the water which reaches the earth bright and clear rapidly becomes affected, as can be seen in any country stream after a few hours' heavy rain. It then rushes along muddy and turbid, and varying in colour according to the geological character of every district. This,

of course, arises from the fact that in flowing over the land the thousands of little rills which go to form the stream, abrade or rub off the surface of the soil, carrying away its particles in suspension. Thus, in a district such as the neighbourhood of Cardiff, in South Wales, where the marls of the old red sandstone prevail, the flooded streams are of a bright brownish red colour. In parts of Sussex, in the Hastings sand country, the streams are always more or less turbid and grey, on account of the fineness of the material and the ease with which it is washed off the ground. Then, again, we are all familiar with the colour of the streams flowing from peat mosses both in lowland and hill districts, a water which, when seen in a deep reservoir, is apparently the colour of strong coffee or porter.

In addition to these impurities which we can see, water which passes slowly underground through the various rocks, such as chalk or limestone, actually dissolves and carries away parts of them in an invisible form. Thus, a chemist will tell you that a water as bright as crystal may contain, by analysis, 20 or 50 grains of some salt of lime in every gallon. Although you cannot see this, you can readily feel it, for the presence of dissolved lime imparts to a water the character of hardness, and if you attempt to wash your hands in it you will find it impossible without the aid of a very large quantity of soap.

On the contrary, water obtained from springs in such a formation as millstone grit is nearly perfectly soft, and a bath in it is almost like bathing in oil, and you can clean the skin readily without the use of soap. The difference arises from the fact that the chalk is readily soluble by the water, because it always contains some carbonic acid taken from the air, and the millstone grit is a silicious rock not easily dissolved.

In certain parts of the earth, waters are found which, having become impregnated with sulphur or iron, or magnesia, through coming in contact with rocks containing these substances, are used for medicinal purposes, and have led to the establishment of spas such as Bath, Harrowgate and Malvern in this country, and of Carlsbad, and others well known on the Continent. At some of these the water issues from the ground at an abnormally high temperature, and in the district recently desolated by earthquakes and volcanic eruption in New Zealand, fountains of boiling water are scattered over a large area. Here the ejected water, highly charged with silicic acid, has in the course of ages, formed a series of terraces, some brilliantly white and others a delicate pink, which are most beautiful objects, and have been spoken of as the eighth wonder of the world. It is feared that these have been destroyed by the recent catastrophe.

In addition to these various ways in which the character of a water may be altered after it has reached the earth by taking up mineral matters both into suspension and solution, its quality may also be impaired by contact with organic matter both of vegetable and animal origin. About the vegetable little need be said, because for all practical purposes it is quite harmless. The most familiar illustration of its presence is the colour, before referred to, imparted by peat, which may when not present in great excess be entirely disregarded.

The contamination which is really and seriously objectionable is that produced by the excreta of animals, especially of man himself. Water obtained from rivers would therefore naturally fall under suspicion, because these are the main drains of the country and receive the washings of manured lands and the sewage of the towns. The danger is however much mitigated by a beneficent provision of nature, viz., the process of oxidation. The noxious substances forming animal excreta are generally speaking held together very feebly by their chemical affinities, and the free oxygen contained in running water attacks them immediately it comes into contact with them, and speedily and absolutely transmutes the great bulk of them into inert and quite harmless compounds. It is now thought that minute living organisms play an important part in this operation. That such a conversion takes place has been proved by thousands of chemical analyses, and it is demonstrated by the evidence of our senses, and the very fact of the continued existence of many of our rivers in practically the same condition for generations. In very populous manufacturing districts, however, where the town populations are generally congregated along the banks of the rivers the most serious pollution takes place, both from sewage and trade refuse, so much so as to render the water totally unfit for human consumption. In these districts impounding reservoirs have almost universally been constructed among the hills, and water suitable both for domestic and manufacturing purposes has thus been obtained.

London, the largest city in the world, still obtains 87 per cent. of its supply from the Rivers Thames and Lea, and its acknowledged position as the healthiest large city in the world, goes far to prove that the water cannot possibly be anything but safe and wholesome. It is only right, however, to point out that during the last twenty years most of the towns situated upon the banks of these rivers have, under pressure of the law, ceased to discharge crude sewage into them, and have carried out works for its interception and treatment upon land, or by some chemical process, so as to render it practically harmless. But for this fact, and the improvements

simultaneously effected in their settling and filtering appliances by the Water Companies, the supply to London would by this time have been greatly discredited, and public opinion woul have demanded its supersession. Now, the reports of all the chemists who are constantly examining it, prove conclusively that the quality of the water, as delivered to the consumers, is steadily improving rather than deteriorating. In passing, I may say that these examinations are becoming more interesting every year, as scientific men devise new methods, and it would appear as if we were now opening out quite a new epoch by the device for localising, enumerating, and classifying the minute living organisms which exist in all waters, and are known by the name of bacteria. So far as these researches have already gone, it is comforting to learn that whilst a few individuals may occasionally be found which are injurious, the immense majority are not only harmless but positively beneficial in a water containing them, and, moreover, some authorities contend that it is the function of the harmless creatures to devour and exterminate the harmful.

After these few desultory remarks, which have only just touched the main points of the general subject, let us for a few minutes see how they apply to the waterworks of York, some particulars of which have been kindly furnished to me by the Secretary, Mr. J. D. Watson. The first works of public supply for the city were established in the year 1682, at the Lendal Tower, adjoining Lendal Bridge, the water being pumped from the river by two horses, and distributed through pipes formed of bored-out trunks of trees. About 1790 a steam engine was erected at the same spot, and in 1799 the works—which up to that time had belonged to a family of the name of Thornton—were sold to a Company, who raised the tower and effected other improvements. They had then an engine of 18 h.p., capable of pumping something over 200,000 gallons in twelve hours. Half the city was supplied for two hours on Mondays, Wednesdays, and Fridays, and the other half on Tuesdays, Thursdays, and Saturdays. At the beginning of this century only 1500 families took water from these works, many others obtaining it from water carts at a penny a bucket, or about a £ per 1000 gallons. Between 1800 and 1810 iron pipes were first laid to replace the "old trees." At that time no attempt was made to filter the water. In 1846 a new company was formed, under an Act of Parliament, with a capital of £80,000, who purchased the old undertaking, and established new works on the present site, at a point about a mile and a half above Lendal Bridge, under the advice of the late Mr. James Simpson, Civil Engineer, of London. In 1876,

further Parliamentary powers were obtained, and the works were enlarged for the Company by Messrs. T. and C. Hawksley. The drainage area of the river down to the point of intake is over 1200 square miles, and embraces the watersheds of the Swale, the Ure, and the Nidd with their numerous tributaries. It extends nearly sixty miles in a north-westerly direction from York, and rises up to 2320 feet above the sea at its highest point, near Kirkby Stephen; along its western and northern boundaries the elevation averages 1230 feet, and at its most easterly point it is only 39 feet.

Covering so large a tract of country from west to east, and varying so greatly in elevation, we may expect to find a marked difference in the rainfall; and this is the fact, for near the western ridge it amounts to 60 inches, and at York itself is under 27 inches per annum. Probably, the average annual rainfall over the whole area will approximate to 32 inches. It is not easy to estimate how much of this will run off by the rivers, but between 30 and 50 per cent. will be re-evaporated, and some will percolate into the ground and be lost, so far as the river is concerned. The extent of the watershed area ensures, however, that there will always be a sufficient supply for the population to be served without the necessity of constructing impounding and storage reservoirs. I should expect that in times of the severest drought the flow in the river past the waterworks will never be less than 100 million gallons a day, which is 40 times as much as York now needs.

The watershed area varies not only in elevation and rainfall, but very considerably in its geological formation. Proceeding from east to west, it embraces middle and lower oolite, lias, new red sandstone, magnesian limestone, lower red sandstone, millstone grit, Yoredale rocks, and mountain limestone. From the millstone grit and some of the red sandstone the water will be soft, but there is evidently a considerable area—at all events where percolation largely takes place—of limestone and other such rocks, for the mixed water as it reaches York has a hardness of 12 to 13 degrees on Clarke's scale; that is, it contains nearly 13 grains of carbonate of lime, or its equivalent in every gallon, and it must therefore be classed as a somewhat hard water. This, although probably no drawback for drinking, is undoubtedly disadvantageous for washing, manufacturing, and, I believe, cooking purposes. At Lancaster, in the adjoining county, the water is obtained entirely from springs in the millstone grit, and its hardness is only about one degree, and consequently the quantity of soap required there will be only a fraction of what is needed by a similar number of people in York. Possibly this is not an unmixed advantage.

The rivers draining the watershed flow principally through an agricultural district, and are not polluted by manufacturing refuse, like the Aire and Calder in neighbouring valleys, and there are no large towns upon them from which they are fouled by sewage. Borobridge, a town of 5,000 inhabitants, is the nearest, being situated upon the river Ure, about twenty miles above York. In all ordinary times any polluting matter which passes into the river there will have disappeared by oxidation long before it reaches the point of intake. Analyses prove that, so far as chemists can judge, the water is delivered in the city pure and wholesome.

In the higher portions of the watershed area there are patches of peaty land, and therefore it occasionally happens in the autumn that the water comes down with the characteristic peat stain, but to an extent which is quite immaterial.

At the works the water is taken into three subsiding reservoirs, holding together 6,800,000 gallons, or three days' supply, in which the heavier suspended matters are deposited, and then passes on to the filter beds which have an area of nearly 10,000 square yards, and are formed in the usual way of gravel and sand, and which remove all traces of turbidity and leave the water bright and practically colourless.

After filtration it is pumped through a 21 inch cast iron pipe up to the service reservoir at Severns Hill, a height of 110 feet above summer river level, and for some time each day over a stand pipe 20 feet higher. From this elevation the pressure is sufficient to force the water through all the mains which distribute it in the city, and to deliver it into all the houses where it can be drawn in abundance by simply turning a tap. By these arrangements half-a-ton of water is now supplied at the price of a bucketful a generation or two ago.

As delivered into your houses you may take it for granted that the water is clean and pure and wholesome, but care must be exercised to prevent its being fouled after delivery and before use. Householders as a rule are very neglectful in this respect. In London many districts receive only an intermittent supply, and therefore it is necessary to have cisterns to store during, say twenty-two hours each day, the water that is delivered in two.

Now I have come across many people living in good houses who have not the faintest idea of the condition of this cistern or even knew where it is. From year end to year end it has remained uncleaned and become the receptacle for dust and dirt, dead birds, dead mice and crawling creatures of all kinds. Frequently too, the cistern is situated in an unventilated and nearly inaccessible attic, and its overflow pipe is connected

direct with the house drain, and therefore leads the gases from the sewers right up into the water. The thoughtlessness of educated people about this matter is utterly disgraceful. I am glad to know that in York your supply is constant, and cisterns are therefore not generally required, but it behoves every head of a family to acquaint himself with the details of all the internal water and drainage arrangements of his house and to assure himself for the sake of his wife and children that neither the water they drink nor the air they breathe is in any way contaminated by causes within his own control.

In conclusion, I wish for two minutes to call your special attention to the usefulness of adopting a regular and systematic course of water drinking as a preservative of health.

I believe there exists very largely a quite erroneous impression on this subject, and in consequence many people are in the habit of drinking too little. I believe that every adult person, especially if past middle age, should drink three to four pints of pure water every day, for the purpose of dissolving and removing from the system the products of disassimilation and waste. If this is not done accumulations of crystalline matters are apt to take place in the organs, producing disease of the most painful and distressing character. Having been myself a sufferer, I am anxious that my experience may be useful to others, especially as it has already been confirmed by the testimony of large numbers. The drinking should be done systematically, viz., on an empty stomach at least one hour before a meal, and very little fluid should be taken whilst eating solid food. By preference the water should be hot, that is to say, over 130° Fahrenheit. Hot water thus taken is most useful in curing indigestion, and indigestion, in my opinion, is at the root of many of our more serious bodily ailments. I cannot now go into further details, but I feel that it is not inappropriate in dealing with my subject to-night, under the auspices of a society having the improvement of the health of the people for its object, to refer thus shortly to a remedy so simple and yet so efficacious.

To all those who have the cause of Temperance at heart—of whom I hope we have a large majority in this room to-night—it will be interesting to learn that systematic hot water drinking has been proved in America to be destructive to the appetite for alcohol, and I myself have heard of cases within the last few months of men losing the desire for their grog at bedtime after a few weeks of hot water.

CLOSING GENERAL MEETING OF THE CONGRESS.

The closing General Meeting of the Congress was held on the afternoon of Friday, September 24th, at the close of the Sectional Meetings. The President, Sir T. Spencer Wells, Bart., took the Chair, supported by the Lord Mayor and other members of the Local Committee, and the Chairman and Council of the Institute.

The Secretary reported that 150 Members of the Institute had been present during the Congress, and that 250 tickets had also been taken by Associates of the Congress.

Votes of thanks were passed to the President, the Local Committee, the Judges and others who had been engaged in the work of the Congress and Exhibition.

The following reports upon the subjects brought forward for consideration at the Sectional Meetings were read by the Senior Secretaries of the respective Sections.

Section I.—SANITARY SCIENCE AND PREVENTIVE MEDICINE.

I have to report that in Section I. the proceedings commenced by the President, Professor de Chaumont, delivering a discourse which placed the Section at once in possession of the facts of our present position as to the causation of disease, and marked the standpoints from which the papers to be submitted might be most profitably considered. The question of Cremation, raised by Mr. William Eassie, C.E., and by Mr. Wilson Robinson, F.L.S., and in which you yourself, Sir, take such great interest, evoked an amount of kindly criticism from ecclesiastics, engineers, chemists, and other authorities, so that Cremation may now be said to have entered the more popular field of public discussion and opinion in this great county of Yorkshire. The temperate manner in which its merits and demerits were discussed is an augury of the impartial mind with which it will be received by the people of the "North Countrie."

The Conference of Medical Officers of Health, which formed part

of this Section, considered the position of the Medical Officer with reference to his appointment, tenure of office, qualification for the post, and his primary duty,—viz., that of controlling infectious disease. These questions were raised in papers by Dr. Bruce Low, Dr. Edward Seaton, Mr. F. Vacher, and myself. That we as Health Officers have still much to learn, was keenly appreciated; but those coming from various populous centres had also much to impart. This Conference will not have been held in vain if it only render those less fairly abreast of present opinion more alive to the welfare of the communities committed to their charge.

The Section continued the following day to entertain various important subjects, amongst which a paper upon the Influence of Milk in the Causation of Disease, was introduced by Dr. Louis Parkes; and one upon the Sphere of Work of Sanitary Associations, by the Rev. J. M. Lambert. These subjects proved of special interest to the ladies.

Year by year the papers in this Section become more numerous and more valuable; and I would again suggest that the Section be subdivided, or that another Section be added to embrace Sanitary Legislation and Administration and kindred subjects. I trust the Council of the Sanitary Institute will take this into serious consideration.

The Section terminated its labours with success, in harmony, and it is to be hoped with profit.

JOHN F. J. SYKES,

Honorary Secretary.

Section II.—ENGINEERING AND ARCHITECTURE.

This Section met at the Museum, and was opened by the President of the Congress, who briefly introduced the President of the Section, Mr. Baldwin Latham.

Mr. Latham read his remarkable address, on "The Influence of Ground-water on Health," showing an unusual amount of original research, and personal labour and expense in the preparation and record of these researches.

The Dean of York proposed the vote of thanks, which was seconded by Mr. Rogers Field, and carried with acclamation.

It was announced that Professor Robinson could not attend through pressure of business, and his paper on "River Pollution" was read by the Senior Secretary of the Section.

Mr. Vickers Edwards' paper was postponed till the next day, at his request; and the discussion took place on Prof. Robinson's paper.

Surgeon-Major Black, Professor Hope, Mr. Rogers Field, Mr. Henry Law, Colonel Jones, Major Flower, Mr. Tarbotton, and Mr.

George Darling (of Leeds), took part in a lively discussion, which turned chiefly upon the relative merits of the solid and liquid disposal of sewage.

The President, in summing up, pointed out some of the advantages of Sewage Farms over which his experience had been exercised.

The Meeting then adjourned for lunch.

On resuming the sitting, papers were read by Alderman Rowntree and Mr. T. H. Harrisson, on Municipal Work, which led to a lively discussion, in which Mr. H. H. Collins, Mr. Lyon, The Lord Mayor, Mr. North, Mr. Rogers Field, Dr. Ewart, Mr. Whitaker, Mr. Tarbotton, Major Flower, Mr. Symons, Mr. Maguire, and Mr. Hanson took part. Mr. Rowntree and Mr. Harrisson answered.

The Meeting closed with the reading of Mr. Tattersall's paper.

Friday, September 24th, 1886.—This Section was continued in the Library, after the opening Address of the President of Section II.

Mr. Gass then read his paper, and Mr. Edwards followed: the discussion of which—and Mr. Tattersall's—was opened by the Senior Secretary of the Section, and continued by Messrs. Tarbotton, Rogers Field, Harrisson, Darley, Gass, Denham, and Emptage.

Mr. Rogers Field announced the speedy publication of the work of the Cowls Committee.

The authors of the papers having replied, the President summed up; and the general feeling was that the business of this Section was well and usefully done, and would prove of good service to the cause. Thanks were voted to the authors of the papers.

EDWARD C. ROBINS.

Honorary Secretary.

Section III.—CHEMISTRY, METEOROLOGY AND GEOLOGY.

The President of the Congress (Sir Spencer Wells) attended at the Museum and introduced Mr. W. Whitaker, F.G.S., President of the Section, who delivered a very lively and extremely interesting Address, dealing chiefly with the water question from a geological aspect, as he very neatly expressed it: "Two of the chief problems in matters sanitary are to get good water, and to get rid of bad water." And he brought the matter home in a most practical way by giving the details of half a dozen gross cases of errors in sanitary matters. He concluded with a protest against the notion which some persons desire to foster, that those who study science in a purely abstract spirit are superior to those who apply their scientific knowledge to the needs of social life. The Address was listened to

with great attention and approval throughout, and a vote of thanks, moved by Alderman Rowntree and seconded by Mr. S. W. North, was carried unanimously.

The first paper, by Lord Brabazon, on the desirability of caring for the body as well as for the mind, and entitled "Open Spaces and Physical Education," was, in his Lordship's absence, read by his Private Secretary. The discussion (but that is hardly the correct term where unanimity prevailed) proved the wide-spread approbation which Lord Brabazon's efforts in this direction have obtained.

Mr. Charles Roberts followed with a paper entitled "On Medical Climatology: a scheme for defining Local Climates by combined Meteorological and Phenological observation." This object is also self-evidently a desirable one, and was supported by every speaker except Surgeon-Major Black, who pointed out that inasmuch as finely grown men were to be found in many manufacturing towns where no tree could grow, there could hardly be a close connection between plant life and human health.

Dr. Percy Frankland's paper on "The Filtration of Water for Town Supply," gave an abstract of his recent observations on London waters by the methods first suggested by Koch, and showed how important was the purifying influence of clean fine sand.

The remaining papers had to be read in abstract in consequence of the shortness of time, but will be found printed *in extenso*, viz.: "On the Sanitary Condition of the Country, with special reference to Water Channels," by Dr. R. T. Cooper, and "On the Collection and Storage of Rain and Drinking Water, with a description of a system for carrying out the same," by Surgeon-Major Pringle, M.D.

G. J. SYMONS,

Honorary Secretary.

MEETING OF SUBSCRIBERS TO THE LOCAL FUND,

HELD AT THE GUILDHALL, YORK,

ON THURSDAY, THE 11th OF NOVEMBER, 1886.

W. REED, Esq., F.G.S., in the Chair.

In opening the proceedings, the Honorary Secretary (Mr. S. W. North) explained that the object for which they were met was to give an account of their stewardship in promoting the success of the Sanitary Congress and Exhibition lately held in York. The Congress was on the whole most satisfactory, and he thought that any person who took part in it could not fail to have been impressed with the fact that the papers read were above the average, and were full of sound and useful knowledge. Besides the Congress, there was an Exhibition in the Fine Art Institution, which he could testify, from his slight acquaintance with the subject, was in every sense a very good Exhibition. The sanitary Exhibits were excellent, and received most careful inspection from the public. The number of persons who attended was not so large as that in some more populous towns, but was larger than was at first anticipated. The Institute had kindly lent the use of the Exhibition for the purpose of holding a *fête* for the benefit of the two leading Medical charities in the city—the York County Hospital and the Dispensary. The *fête* was a very great success, the total receipts being £106 16s., which was to be divided between the two institutions. The whole of the proceedings, both of the Congress and Exhibition, were highly satisfactory, reflecting credit upon the city and those who had taken an active part in them. He could not close these remarks without expressing the great satisfaction it must be to every citizen of York that the city possesses so large and commodious a building as the

Fine Art Institution, without which it would have been quite impossible to have held such a gathering in York. No local fund could have been raised to erect a building large enough to hold all the sanitary exhibits, and it behoved the citizens to keep it in a proper state of efficiency, in order to fulfil the many useful functions, which were more and more required for the discussion of common objects of interest, such as the late Exhibition. The whole of the local expenses of the Congress, &c., had to be borne by the Local Committee, and when the subscription list was opened it was very fairly responded to, but not so liberally as he at first anticipated. It was estimated that between £600 and £700 would be needed, but only £506 was subscribed. Great prudence and economy had thus to be exercised in every department, but notwithstanding this the subscribed fund was not sufficient. Thanks, however, to a sum which was placed at their disposal by the trustees of the Social Science Congress held in York in 1864, they were able to present a clear balance sheet. Out of the same fund it had also been decided to pay the expenses of the Hospital and Dispensary *fête*. He had received a letter from the Secretary of the Sanitary Institute expressing the Council's appreciation of the very complete and satisfactory arrangements made by the Local Committee, and it was no doubt due in a large measure to those arrangements that the Congress proved so successful.

The following resolutions were then adopted:—

"That the Treasurer's statement of accounts now read be received and adopted, and that he be authorised to pay the same. That Mr. Alderman Brown, Mr. C. M. Luden, and Mr. Alderman Rowntree be requested to audit the same, and that after audit a copy of the proceedings at this Meeting be forwarded to each subscriber to the local fund."

"That the best thanks of this Meeting be presented to the Right Hon. the Lord Mayor of York (Mr. Ald. Terry) for the courteous manner in which his Lordship discharged the duties of Chairman of this Committee, and for the hospitality shown by his Lordship and the Lady Mayoress to the Members of the Institute during its recent Congress in York."

"That the best thanks of this Meeting be presented to the Rev. Canon Fleming, B.D., for his kindness in presiding at the Artizans' Meeting, and for the valuable services rendered by him at the Conversazione."

"That the best thanks of this Meeting be presented to Dr. Naylor for the valuable services rendered by him on the occasion of the

Conversazione being held during the recent Meeting of the Sanitary Congress in York."

"That the best thanks of this Meeting be presented to Mr. Skerry for his kindness and trouble in organising and carrying out the details of the Artizans' Meeting in the Festival Concert Room in so satisfactory a manner."

"That the best thanks of this Meeting be presented to the Rev. Canon Raine for his kindness in organising and carrying out an Antiquarian Ramble through the City."

"That the thanks of this Meeting be presented to the Committee of the Wilberforce School for the Blind, and Mr. Buckle, Superintendent, for their liberality in allowing the School to be open to the Members of the Institute during the recent Congress, and for the valuable services rendered by the Pupils of that Institution at the recent Conversazione, under the direction of Mr. William Barnby."

"That the best thanks of this Meeting be presented to the Rev. E. S. Carter and the Rev. A. S. Commeline for their kindness in acting as Honorary Secretaries to the Conversazione Committee and for their valuable services."

"That the best thanks of this Meeting be presented to Mr. Alderman Close (ex-Lord Mayor of York) for the courteous manner in which he has discharged the duties of Honorary Treasurer."

"That the best thanks of this Meeting be presented to the Council of the Sanitary Institute of Great Britain, for its liberality in placing at the disposal of the Local Committee the Exhibition and Staff free of cost, for one evening, in aid of the Funds for the Fête organised on behalf of the York County Hospital and York Dispensary, and to Mr. Box, the Curator, for his courteous assistance in connection therewith."

"That the best thanks of this Meeting be presented to the Chairman and Directors of the York New Waterworks Company for their hospitality to, and for the admirable arrangements made for, the Members of the Institute to inspect the works of the Company at Acomb Landing."

"That the best thanks of the Meeting be presented to the Directors of the York United Gas Light Company for their kindness in allowing the Members of the Sanitary Congress to visit their works."

"That the best thanks of the Meeting be presented to the House Committee of the York County Hospital for their kindness in allowing the Members of the Sanitary Congress to visit the Hospital."

"That the best thanks of the Meeting be presented to the Directors

of the North Eastern Railway Company for their kindness in allowing the Members of the Sanitary Congress to visit their works."

"That the cordial thanks of this Meeting be presented to the Very Rev. the Dean and Chapter of the Cathedral for their kindness in allowing the Members of the Sanitary Institute to visit the Cathedral and Crypt."

"That the thanks of this Meeting be presented to the Council of the Yorkshire Philosophical Society for their liberality in placing at the disposal of the Executive Committee the Theatre and Library of the Museum for the use of the various Sections, and for granting Members of the Institute free admission to the Museum and Grounds of the Society.

"That the thanks of this Meeting be presented to the President, Secretary, and Members of the York Subscription Library for their kindness in allowing the Library to be open for the use of the Members of the Institute during the recent Congress in York."

"That the thanks of this Meeting be presented to the Committee of Management of the York Institute of Popular Science and Literature for their kindness in allowing the Institute to be open for the use of the Members of the Sanitary Congress during the recent Meeting in York."

"That the best thanks of this Meeting be presented to R. W. Boyce, Esq., Governor of York Castle, for his courtesy and kindness in allowing the Members of the Sanitary Institute, attending the Congress at York, the privilege of visiting the Prison and the Ruins of Clifford's Tower."

"That the thanks of this Meeting be presented to the Lord Mayor and Corporation of the City of York for their kindness in permitting the Members of the Sanitary Congress to visit the Fever Hospital, for their liberality in placing the use of the Council Chamber at the disposal of this Committee, and for their co-operation in promoting the success of the Congress and Health Exhibition."

"That the thanks of this Meeting be presented to the Local Hon. Secretaries of Section I.: Sanitary Science and Preventive Medicine, viz., Henry E. Spencer, L.R.C.P.; Francis H. Weeks, F.R.C.S. Section II.: Engineering and Architecture: M. J. Adams, G. J. Monson, A.M.INST.C.E. Section III.: Chemistry, Meteorology, and Geology: T. Gough, B.SC., F.C.S.; H. M. Platnauer, A.R.S., F.G.S.; and to the Hon. Secretaries to Local Sub-Committees, S. H. Adams and Mr. Councillor Procter."

"That the best thanks of this Meeting be presented to Mr. Buckle

(Master of the Yorkshire School for the Blind), Mr. Platnauer (Curator of the Yorkshire Philosophical Society), Mr. Robinson (Master of the Blue Coat School), and H. E. Spencer, Esq., for their valuable services at the recent Conversazione and Hospital and Dispensary Fête, and to Mr. Holmes for the gratuitous loan and management of the Oxy-Hydrogen Light on the last occasion."

"That the best thanks of this Meeting be presented to the Committee of the York Industrial Schools for permitting the Members of the Sanitary Congress to visit the Boys' School at Marygate, and the Girls' School, Lowther Street."

"That the best thanks of this Meeting be presented to the York and Leeds Press for their valuable Reports of the Meetings of Congress and of the Health Exhibition."

"That the cordial thanks of this Meeting be presented to the Subscribers to the Local Fund."

Proposed by Mr. Luden, seconded by Mr. Skerry, and carried by acclamation, "that the thanks of the Citizens are due to the Subscribers to the Local Fund, for having promoted so interesting and successful a Congress and Exhibition."

Mr. Luden proposed a vote of thanks to S. W. North for his valuable services, which was carried by acclamation.

Mr. North, in reply, referred to the valuable aid he had received from Mr. Wilson, the Assistant Secretary.

W. REED, *Chairman.*

A vote of thanks to the Chairman was also carried by acclamation.

S. W. NORTH, *Hon. Sec.*

REPORT OF THE JUDGES OF THE EXHIBITION, YORK, 1886.

We, the undersigned, the Judges appointed by the Council, beg leave to recommend to the Council the following distribution of Medals and Special Certificates, and of Certificates of Merit.

Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from awards of Medals, but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following lists by asterisks.

Objects exhibited or invented by any of the Judges themselves are excluded from awards of Medals or Certificates; consequently the "Dececo" Water-closet and Flushing Cistern, exhibited by Messrs. Cliff & Co., which is an application of an invention of Mr. Rogers Field, is excluded from any award.

The Richardson Medal *for an* Exhibit selected from the entire Exhibition *will be awarded by the Judges in case of pre-eminent merit only.*

MEDALS AND STARRED CERTIFICATES.

CLASS I.—CONSTRUCTION AND MACHINERY.

Casebourne & Co., *West Hartlepool*, for Faija's Cement Testing Machine.

Dœker Hospitals and Huts Factory, *London*, for Dœker Portable Hospital.

Harris, J. F. & G., *London*, for Moulded Wood Decoration.

Kenworthy, E. N., & Co., *Oldham*, for Equipoise Wringing and Mangling Machine.

*Leggott, W. & R., *Bradford*, for Opener for Fanlight and Skylight.

Waterproof Paper and Canvas Company, *London*, for Willesden Paper Roofing.

CLASS II.—SEWERAGE AND WATER SUPPLY.

*Cliff, J., & Sons, *Leeds*, for Imperial Porcelain Bath.
*Greenall, J., *Manchester*, for Steam-Washer.
*Morrell's Sanitary Appliance Company, *Manchester*, for Portable Cinder Sifting Ash Closet.
*Moule's Earth Closet Company, *London*, for Moule's Earth Closet.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

Davis, H. & C., & Co., *London*, for Enamelled "Metropolitan" Gas Cooking Stove.
*Davis, H. & C., & Co., *London*, for Fibre Asbestos Open Gas Fire.
*Foulds, E., *Leeds*, for Crabtree Kitchen Range.
Woodhouse and Rawson Electric Supply Company of Great Britain, *Bradford*, for Magnetic Cut Out for Electric Lighting.
*Woodhouse and Rawson Electric Supply Company of Great Britain, *Bradford*, for Incandescent Lamps.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

Aylesbury Dairy Co., *London*, for Exhibit of Dairy Appliances.
*Calvert, F. C., & Co., *Manchester*, for Carbolic Acid for Disinfecting Purposes.
Dr. Jaeger's San itary Woollen System Co., *London*, for Sanitary Clothing.
*Hancock, F. & C., *Dudley*, for Machines for domestic use.
*Lyon, Washington, *London*, for Lyon's Steam Disinfector.
Ward, E., & Co., *Bradford*, for Exhibit of Sanitary Clothing.
Wilberforce School for the Blind, *York*, for Wickerwork and Brushes.

CERTIFICATES OF MERIT.

We further recommend that Certificates of Merit be awarded to the undermentioned Exhibitors:—

CLASS I.—CONSTRUCTION AND MACHINERY.

Cliff, J., & Sons, *Leeds*, for Hall's Hanging Tiles.
Cliff, J., & Sons, *Leeds*, for White and Coloured Glazed Bricks.
Cordingley, T. & Son, *Bradford*, for Improved Fibrous Plaster Work.
Duffy, M. C., & Son, *London*, for Immovable "Acme" System of Solid Wood Block Flooring.

Hindle, Norton & Co., *Oldham*, for Acme Door Check and Spring (double action).

Kenworthy, E. N., & Co., *Oldham*, for Paragon Washing Machines.

Nightingale & Co., *Great Grimsby*, for Method of Wood Block Flooring.

Smith, E., & Co., *Coalville*, for Vitreous Floor Tiles.

Wortley Fire Clay Company, *Leeds*, for White and Coloured Glazed Bricks.

Wortley Fire Clay Company, *Leeds*, for Salt-glazed Bricks.

Wright & Co., *London*, for Fireproof Fixing Blocks.

CLASS II.—SEWERAGE AND WATER SUPPLY.

Adams & Co., *York*, for 30 Gallon Combined Flush-tank and Grease Interceptor.

Bailey & Co., *London*, for Woodman's Stoneware Screw Plug and Collar, for access to Drains.

Braithwaite, H., & Co., *Leeds*, for Siphon Action Water-waste Preventor.

Burn & Baillie, *London*, for Galvanized Cast-iron Air-tight Inspection Chamber and Drain Pipes.

Burn & Baillie, *London*, for "Eclipse" Apparatus for Testing Drain and other Pipes.

Burn & Baillie, *London*, for Indiarubber Expanding Plug for Drain Testing.

Barrett, H. J., *Hull*, for Steel Wheel for Sanitary Carts.

Casebourne & Co., *West Hartlepool*, for Schaible's Apparatus for the Estimation of Carbonate of Lime in Cement.

Cliff, J., & Sons, *Leeds*, for White Enamelled Sinks.

Cliff, J., & Sons, *Leeds*, for White Enamelled Urinal Floor Channel.

Cliff, J., & Sons, *Leeds*, for Simplex Reversible Gully.

Cliff, J., & Sons, *Leeds*, for "Imperial" Slop Sink.

Potter, G. W., *London*, for "Siphozella" Pipe Fastening.

Phillips, W., & Son, *London*, for Bronte's Air-tight Cast-iron Manhole Cover.

Trott, H., *London*, for Bib Valves for Hot and Cold Water.

White, W. P., & Co., *London*, for Nicholl's Hospital Pail.

Wortley Fire Clay Company, *Leeds*, for White Enamelled Sinks.

Wortley Fire Clay Company, *Leeds*, for Simpson's Street Gully.

Wragg, T., & Sons, *Burton-on-Trent*, for Mawbey's Joint for Stoneware Pipes.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

Greenall, J., *Manchester*, for Marsh-Greenall Regenerative Gas Heating Stove.

Hindley, E. S., *Bornton*, *Dorset.*, for Alcazar Vertical Steam Engine.

Wilson, Chas., & Sons, *Leeds*, for Radiating Gas Fire.

Woodhouse and Rawson Electric Supply Company of Great Britain, *Bradford*, for Combination Plug and Metre Bridge (Davies and Moynhan's Patent).
Wright, J., & Co., *Birmingham*, for large Gas Cooking Stove.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

Aylesbury Dairy Co., *London*, for Butter Squeezing Machine.
Bolonachi, A. J. M., *London*, for Chocolate Paste.
Burroughs, Wellcome, & Co., *London*, for Preparations of Digestive Ferments.
Burroughs, Wellcome, & Co., *London*, for "Lanolin" Soap.
Calvert, F. C., & Co., *Manchester*, for Preparations from Carbolic Acid.
Calvert, F. C., & Co., *Manchester*, for Carbolic Acid Soaps.
Clark, E., & Co., *London*, for Optimus Coffee Extract.
Dillon, E. & C., *York*, for Ventilating Corsets.
Dr. Jaeger's Sanitary Woollen System Co., *London*, for Camel's Hair Clothing and Bedding.
Edmunds, Jos., *London*, for Chutneys.
Hancock, F. & C., *Dudley*, for New Cooker and Steamer.
Jeyes' Sanitary Compounds Co., *London*, for Perfect Purifier.
King & Co., *Hull*, for Fishburn's Tubular Refrigerators.
King & Co., *Hull*, for Fishburn's Scarboro' Freezer.
Longford Wire, Iron, and Steel Co., *Warrington*, for Wood's Double Woven Galvanized Steel Wire Spring Mattress.
North of England School Furnishing Co., *Darlington*, for Westminster Single Desk, with Sliding Top and Convex Suppor to the Seat.
Scott, A. & R., *Glasgow*, for Improved Oat Cakes.
Senn, C. H., *London*, for Preserved Fruits.
Torrance, W. H., *Edinburgh*, for Rusks, Oat Cakes, and Shortbread.
Ward, E., & Co., *Bradford*, for Hygeia Corset.
Ward, E., & Co., *Bradford*, for "Arachne" Flannel.

EXHIBITS SELECTED FOR FURTHER PRACTICAL TRIAL.

With regard to the following Exhibits, the Judges are unable to give their decision until they have submitted the Exhibits to a more complete and extended practical examination than is possible at the Exhibition :—

CLASS I.—CONSTRUCTION AND MACHINERY.

Casebourne & Co., *West Hartlepool*, Portland Cement.
Sanitary Dry Lime Co., *Liverpool*, Dry Mortar.
Sanitary Dry Lime Co., *Liverpool*, Sanitary Dry Lime.

CLASS II.—SEWERAGE AND WATER SUPPLY.

Adams & Co., *York*, Sewer Ventilator and Sewer Gas Deodorizer for Manholes.

Burn & Baillie, *London*, Combination Bath Fittings.

Cliff, J., & Sons, *Leeds*, "Cecil" Slop Sink with Flushing Rim.

Doulton & Co., *London*, Lavatory Valves.

Doulton & Co., *London*, Self-adjusting Joints for Stoneware Pipes.

Gray, J. W., & Son, *London*, Howatson Water Softener.

Maignen, P. A., *London*, Dry Water-softening Process.

White, W. P., & Co., *London*, Dry Closets.

Wragg, T., & Son, *Swadlincote*, Hassall's Safety Joints for Drains.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

Æolus Waterspray Ventilating Co., *London*, Æolus Waterspray Ventilators.

Æolus Waterspray Ventilating Co., *London*, Large Ventilating Gas Stove.

Æolus Waterspray Ventilating Co., *London*, Electric Lighting by Primary Battery.

Doulton & Co., *London*, Open Portable Radiating Tile Stove for Gas.

Hale, R. W., & Co., *London*, Exhaust and Downcast Ventilators.

Honeyman, J. *Glasgow*, Diaphragm Ventilator.

King & Co., *Hull*, Phillip's Ventilator.

Kite, C., & Co., *London*, Exhaust, Downcast, and Chimney-breast Ventilators.

Torrance, W. H., *Edinburgh*, "Yorkshireman" Gas Oven.

Wright, E. G., *Portsmouth*, Reliance Chimney Cowl.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

Bailey & Co., *London*, Irving's Filter.

Barstow, J., *Pontefract*, Combination Water Filters.

Burroughs, Wellcome, & Co., *London*, Malt Extract.

Calvert & Co., *Manchester*, Borophenol.

Craven, M. A., & Son, *York*, Coloured Confectionery.

Doulton & Co., *London*, Improved Manganous Carbon Filter.

Duffin, T., & Sons, *York*, Mineral Waters.

Gittens, C. E., *London*, Queen Filter.

Leach, T., *York*, Mineral Waters.

Lever, Bros., *Warrington*, Sunlight Self-washer Soap.

Magnetic Filter Co., *London*, Spencer's Magnetic Filter.

Maignen, P. A., *London*, Filtre Rapide.

Montgomerie, J., *Glasgow*, Malt Bread and Biscuits.

Sanitary Dry Lime Co., *Liverpool*, Sanitary Dry Lime Disinfecting Powder.

Silicated Carbon Filter Co., *London*, Improved Silicated Carbon Filters.

Woolley, James, Sons, & Co., *Manchester*, Sanitary Rose Powder.

SUPPLEMENTARY REPORT OF THE JUDGES ON THE EXHIBITS DEFERRED FOR FURTHER PRACTICAL TRIAL.

Out of the forty-two exhibits deferred for further practical trial, as mentioned in the Report, the following were submitted by the exhibitors:—

Casebourne & Co., *West Hartlepool*, Portland Cement.

Sanitary Dry Lime Co., *Liverpool*, Dry Mortar.

*Sanitary Dry Lime Co., *Liverpool*, Sanitary Dry Lime.

Burn & Baillie, *London*, Combination Bath Fittings.

Doulton & Co., *London*, Lavatory Valves.

Doulton & Co., *London*, Self-adjusting Joints for Stoneware Pipes.

*Gray, J. W., & Son, *London*, Howatson Water Softener.

White, W. P., & Co., *London*, Dry Closets.

Wragg, T., & Son, *Swadlincote*, Hassall's Safety Joints for Drains.

*Æolus Waterspray Ventilating Co., *London*, Æolus Waterspray Ventilators.

*Æolus Waterspray Ventilating Co., *London*, Large Ventilating Gas Stove.

*Honeyman, J., *Glasgow*, Diaphragm Ventilator.

Wright, E. G., *Portsmouth*, Reliance Chimney Cowl.

*Bailey & Co., *London*, Irving's Filter.

Burroughs, Wellcome, & Co., *London*, Malt Extract.

Calvert & Co., *Manchester*, Boro-Phenol.

Craven, M. A., & Son, *York*, Coloured Confectionery.

Duffin, T., & Sons, *York*, Mineral Waters.

Gittens, C. E., *London*, Queen Filter.

Leach, T., *York*, Mineral Waters.

Lever, Bros., *Warrington*, Sunlight Self-washer Soap.

*Magnetic Filter Co., *London*, Spencer's Magnetic Filter.

Montgomerie, J., *Glasgow*, Malt Bread and Biscuits.

*Sanitary Dry Lime Co., *Liverpool*, Sanitary Dry Lime Disinfecting Powder.

Silicated Carbon Filter Co., *London*, Improved Silicated Carbon Filters.

Woolley, James, Sons, & Co., *Manchester*, Sanitary Rose Powder.

Fraser, J., *Leeds*, Atlas Telephone.

The Stanhope Co., Limited, *London*, Electro-Magnetic Telephones.

We recommend that Medals should be awarded to the undermentioned Exhibitors :—

DOULTON & Co., *Lambeth*, for Self-adjusting Joint for Stoneware Pipes.

WHITE, W. P., & Co., *London*, for Nicholls' Soot and Salt Closet.

WRAGG, T., & SON, *Burton-on-Trent*, for Hassall's Joint for Stoneware Pipes.

M. A. CRAVEN & SON, *York*, for Coloured Confectionery.

We also recommend that Certificates of Merit should be awarded to the undermentioned exhibitors :—

BURN & BAILLIE, *London*, for Combination Bath Fittings.

BURROUGHS, WELLCOME & Co., *London*, for Malt Extract.

CALVERT, F. C., & Co., *Manchester*, for Boro-Phenol.

MONTGOMERIE, J., *Glasgow*, for Infant Rusks and Nursery Biscuits.

THE STANHOPE Co., LIMITED, *London*, for Electro-Magnetic Telephones.

WOOLLEY, JAMES, & Co., *Manchester*, for Sanitary Rose Powder.

LEVER BROS., *Warrington*, for Sunlight Soap.

BROAD & Co., *Paddington*, for Rock Buff Facing Bricks.

This was exhibited at Leicester, but the testing was not completed in time for the last Report.

We have not yet had sufficient opportunity of testing the exhibits marked with an asterisk, and they are therefore of necessity deferred for a future Report.

We regret that we are unable to recommend the award of the Richardson Medal.

W. H. CORFIELD, CHAIRMAN.
A. WYNTER BLYTH.
W. EASSIE.
ROGERS FIELD.
HENRY LAW.
J. WALLACE PEGGS.
H. SAXON SNELL.
ERNEST TURNER.

CLASS V.—MISCELLANEOUS ARTICLES OF SANITARY INTEREST NOT INCLUDED IN THE ABOVE CLASSES.

ÆOLUS WATERSPRAY VENTILATING CO., *London*, Bing's Acoustic Mechanical Telephones.

J. FRASER, *Leeds*, Atlas Telephone.

THE STANHOPE CO., LIMITED, *London*, Electro-Magnetic Telephones.

THE STANHOPE CO., LIMITED, *London*, Bing's Acoustic Mechanical Telephones.

Stanford's Joints for Stoneware Pipes, and Stott's Gas Governor, which have gained Medals and Starred Certificates at previous Exhibitions, are now so well known, and their Merits are so fully appreciated, that the Judges do not think it necessary to make any further award for them.

(*Signed*) W. H. CORFIELD, M.A., M.D., OXON., *Chairman.*
A. WYNTER BLYTH, M.R.C.S.
F. S. B. F. DE CHAUMONT, M.D., F.R.S.
W. EASSIE, C.E., F.L.S., F.G.S.
ROGERS FIELD, B.A., M.Inst.C.E.
HENRY LAW, M.Inst.C.E.
J. WALLACE PEGGS, A.M.Inst.C.E.
H. SAXON SNELL, F.R.I.B.A.
ERNEST TURNER, F.R.I.B.A.

LOUIS PARKES, M.D.,
Secretary to the Judges.

APPENDIX.

EXAMINATIONS IN SANITARY SCIENCE FOR LOCAL SURVEYORS AND INSPECTORS OF NUISANCES.

BOARD OF EXAMINERS.

Chairman.

CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

A. WYNTER BLYTH, M.R.C.S.
PROF. W. H. CORFIELD, M.A.LOND., M.D.OXON.
PROF. F. S. B. F. DE CHAUMONT, M.D., F.R.S.
ROGERS FIELD, B.A., M.INST.C.E.
W. H. MICHAEL, Q.C., F.C.S.
LOUIS PARKES, M.D.
PROF. H. ROBINSON, M.INST.C.E.
H. SAXON SNELL, F.R.I.B.A.
J. F. J. SYKES, B.SC. PUB. HEALTH, M.B., F.R.C.S.
M. OGLE TARBOTTON, M.INST.C.E., F.G.S.
ERNEST TURNER, F.R.I.B.A.

Registrar.

G. J. SYMONS, F.R.S.

THE great and increasing importance of the duties devolving upon Local Surveyors and Inspectors of Nuisances in connection with the various Acts relating to Public Health, the Sale of Food and Drugs, &c., led the Council of the Sanitary Institute of Great Britain to establish Voluntary Examinations, to appoint a Board of Examiners, and to grant Certificates of Competency to Local Surveyors and Inspectors of Nuisances.

Visitors duly appointed by the Local Government Board and various bodies connected with the practical application of sanitary science are invited to be present at the Examinations.

The Examinations are arranged in two grades, and are intended to enable Local Surveyors and Inspectors of Nuisances, or persons desirous of becoming such, or of obtaining the Certificate of the Institute, to prove their competency in the subjects of Examination. A register of Successful Candidates is kept at the Offices of the Institute, and a copy will be forwarded to Local Boards and Sanitary Authorities on application.

Each Examination occupies a portion of two days. On the first day the Examination of Surveyors occupies four hours—viz., from 11 a.m. till 1 p.m., and from 4 till 6 p.m., and consists of written papers only. Inspectors of Nuisances have two hours' written examination on the first day—viz., from 1.30 p.m. till 3.30 p.m. On the second day the Examination, for both classes, commences at 11 a.m.,

and is *vivâ voce*, with one or more questions to be answered in writing, if deemed necessary. A Certificate of Competency, signed by the Examiners, is granted to successful Candidates, entitling them to be designated as "Certificated by the Sanitary Institute of Great Britain."

As one person may, under the Public Health Act, 1875, be both Local Surveyor and Inspector of Nuisances, the Examinations are so arranged that Candidates who desire to do so, *can* enter for both Examinations on the same occasion, but they are not advised so to do.

Candidates are required to furnish the Board of Examiners with satisfactory testimonials as to personal character, and to give two weeks' notice previous to presenting themselves for Examination, stating whether they wish to be examined as Surveyors, as Inspectors of Nuisances, or as both. The fee for Examination must be paid to the Secretary, by Post-Office order or otherwise, at least six days before the day of Examination. On the receipt of the fee, a ticket will be forwarded admitting to the Examination.

The fees payable for the Examinations are as follows :—

As Surveyors	£5 5s.
As Inspectors of Nuisances . .	£2 2s.

Unsuccessful Candidates are allowed to present themselves a second time without additional payment.

Examinations are appointed to be held for the year 1887 :—

On Thursday and Friday, **June 2nd and 3rd.**
On Thursday and Friday, **November 10th and 11th.**

The Forms to be filled up by Candidates and their recommenders previous to Examination will be supplied on application to the Secretary, 74A, Margaret Street, W.

SYLLABUS of SUBJECTS for EXAMINATION.

FOR LOCAL SURVEYORS.

Laws and Bye-Laws—A thorough knowledge of the Acts affecting Sanitary Authorities, as far as they relate to the duties of Local Surveyors; also, of the Model Bye-Laws issued by the Local Government Board.

Sewerage and Drainage—The Sanitary principles which should be observed in the preparation of schemes for, and the construction of, Sewerage works; the ventilation and flushing of sewers and drains; the internal drainage and other Sanitary arrangements of houses, privies, water-closets, dry-closets, and the removal of refuse; the Sanitary details of Builders' and Plumbers' work.

Water Supply of Towns and Houses—The Sanitary principles which should be observed in the preparation of schemes for, and the construction of, Water-works; the various ways in which water is likely to become polluted, and the best means of ensuring its purity.

Regulation of Cellar Dwellings and Lodging Houses—General principles of Ventilation; the amount of air and space necessary for men and animals; the means of supplying air, and of ensuring its purity.

Highways and Streets—The Sanitary principles which should be observed in the construction and cleansing of streets and roads.

All persons who have passed the above Examination and received the Certificate for Local Surveyors are, by virtue of having so passed, entitled to become Life Members of the Institute, upon payment of Five Guineas, in addition to the fee paid for the Examination.

FOR INSPECTORS OF NUISANCES.

A thorough knowledge of the Provisions of the Acts and Model Bye-Laws relating to the duties of Inspector of Nuisances—also of the working of the Sale of Food and Drugs Act.

A fair knowledge of the principles of Ventilation, and the simple methods of Ventilating Rooms—Measurement of Cubic Space.

A knowledge of the Physical Characteristics of Good Drinking Water—the various ways in which it may be polluted, and the means of preventing pollution—Methods of Water Supply.

A knowledge of the proper conditions of good drainage.

The advantages and disadvantages of various Sanitary Appliances for Houses—Inspection of Builders' and Plumbers' work.

A knowledge of what constitutes a Nuisance, arising from any Trade, Business, or Manufacture.

A fair knowledge of the characteristics of good and bad Food (such as Meat, Fish, Milk, Vegetables), so as to be able to recognise unsoundness.

Some knowledge of Infectious Diseases, and of the Regulations affecting persons suffering or recovering from such diseases.

A knowledge of the best Methods of Disinfection.

Methods of Inspection, not only for Dwellings, Cellar Dwellings, Dairies, and Milk-Shops, but of Markets, Slaughter-Houses, Cow-Sheds, and offensive Trades.

Scavenging and the Disposal of Refuse.

All persons who have passed the above Examination and received the Certificate for Inspectors of Nuisances are, by virtue of having so passed, entitled to become Life Associates of the Institute, upon payment of Three Guineas, in addition to the fee paid for the Examination.

EXAMINATIONS FOR LOCAL SURVEYORS AND INSPECTORS OF NUISANCES.

The following Candidates received Certificates during the year 1886.

LOCAL SURVEYORS.

Nov. 12, Anderson, John Reid, Norwood, S.E.
June 4, Beard, E. T., Lincoln.
Nov. 12, Curwen, John F., Hampstead, N.W.
Nov. 12, Metcalf, John W., York.
June 4, Morley, J. G., Forest Gate, E.
June 4, Parry, W. Henry, Monkstown, Co. Dublin.
Nov. 12, Smith, Charles Chambers, Skipton.
June 4, Tulloch, F. H., A.M.Inst.CE., Southend.
June 4, Witts, T. W., Skelton-in-Cleveland.

INSPECTORS OF NUISANCES.

June 4, Anderson, Tom, Camden Town, N.W.
June 4, Ashdown, T., Brighton.
Nov. 12, Barfoot, James, Battersea, S.W.
Nov. 12, Barron, John, Stockwell, S.E.
June 4, Bartlett, George, Brixton.
June 4, Bascombe, H. C., Bristol.
June 4, Bateman, C. G., Pewsey, Wilts.
June 4, Black, A. E., Inverness.
Nov. 12, Bostel, Daniel Bartley, Brighton.
Nov. 12, Bostel, G. Stanford, Charing Cross, S.W.
Nov. 12, Bowyer, Harry D., Slough.
Nov. 12, Bradshaw, Edmund, Liverpool.

June 4, Brooke, J. W., Marlborough, Wilts.
Nov. 12, Brown, Charles E., Holloway, N.
June 4, Brownings, H., Brighton.
June 4, Bull, A. R., Chelsea, S.W.
June 4, Burscough, F. P., Oswaldtwistle.
Nov. 12, Chadderton, Albert, Oldham.
June 4, Chamberlain, R., Hammersmith.
Nov. 12, Christie, David, Hull.
June 4, Clayton, Edward, Mansfield.
Nov. 12, Clayton, William Hatch, Cardiff.
Nov. 12, Cobham, G. W., Gravesend.
June 4, Cooper, James, Liverpool.
June 4, Cooper, W. W., Hinckley.
June 4, Cox, Charles, Mile End, E.
June 4, Crane, S., Battersea, S.W.
June 4, Darley, G., Leeds.
Nov. 12, Elliott, John J., South Shields.
June 4. Evans, J. Evan, Battersea, S.W.
June 4, Freeman, T. H., Battersea.
June 4, Garland, William, Barnstaple.
June 4, Green, William, Cardington St., Euston Square, N.W.
June 4, Gunn, Alexander, Aberdeen.
June 4, Hampson, M., Oldham.
Nov. 12, Hart, John William, Clapham.
June 4, Haworth, John, Whitefield.
June 4, Hildreth, J. W., Bishop's Road, E.
Nov. 12, Hodges, A., Wolverhampton.
Nov. 12, Huxley, Joseph, Bootle.
Nov. 12, Jameson, Joshua, Birmingham.
Nov. 12, Jones, William, Bangor.
Nov. 12, Jury, Edgar E., Chelsea Bridge, S.W.
June 4, Leverton, J. H., Kilburn, N.W.
Nov. 12, Lindop, Richard C., Stoke-on-Trent.
Nov. 12, Lukes, Arthur Henry, Gravesend.
Nov. 12, MacMahon, Charles, Torquay.
June 4, Massey, J. B., Burnley.
Nov. 12, McCulloch, R., Liverpool.
Nov. 12, McDonald, Adam Luke, Gipsy Hill, S.E.

June 4, Mellow, S. W., St. Luke's, E.C.
June 4, Munro, A. J., Enfield.
Nov. 12, Newberry, W. E., Ashford, Staines.
June 4, Newman, C. F., Tooting.
Nov. 12, Ollett, J. Henry, Highgate Road, N.
June 4, Wreford, W. J. G., Exeter.
Nov. 12, Parsons, William, Brighton.
Nov. 12, Pearson, William Robert, Whitby.
June 4, Phimister, G., Lower Tooting.
Nov. 12, Poole, Charles, Battersea.
June 4, Press, W. J., Burnham, Somerset.
June 4, Radcliffe, J., Rochdale.
Nov. 12, Raimes, Christopher, Westoe.
Nov. 12, Russell, George, Kensington.
June 4, Salter, T., St. Leonards-on-Sea.
June 4, Sargent, John J., Camden Town, N.W.
Nov. 12, Shore, Ambrose J., Peckham Rye.
Nov. 12, Smith, Charles Chambers, Skipton.
Nov. 12, Smith, Edwin, Acton.
June 4, Smith, J. C., Leeds,
Nov. 12, Soper, Henry Charles, Camden Town, N.W.
Nov. 12, Spadaccini, Henry, Popular, E.
Nov. 12, Stone, A. W., Bromley, Kent.
Nov. 12, Tate, William, Kilburn, N.W.
June 4, Taylor, S., Euston Grove, N.W.
June 4, Thompson, A.M., Birmingham.
June 4, Treadwell, W. J., Westbury, Brackley.
Nov. 12, Tunstall, John, Liverpool.
Nov. 12, Turner, Samuel, Birmingham.
June 4, Warren, T. Budd, Southam, near Rugby.
Nov. 12, Webb, James A., Shepherd's Bush.
June 4, Wheeler, W. F., Hackney, E.
June 4, Wilkinson, J., Blackpool.
Nov. 12, Wilson, Charles Turle, Highbury.
Nov. 12, Wood, Charles Bruce, Chelsea Bridge Road, S.W.

EXHIBITIONS OF SANITARY APPARATUS AND APPLIANCES.

The Exhibitions of Sanitary Appliances are held annually in connection with the Autumn Congress, and unpatented exhibits are protected by a certificate granted by the Board of Trade, under the Patents Designs and Trade Marks Act, 1883.

Judges are appointed by the Council to examine the several exhibits, and award Medals and Certificates of Merit to such objects as they may consider worthy.

In addition to the Ordinary Medals, a special Medal — the Richardson Medal—is offered by the Institute, for a selected exhibit from the entire exhibition, and will be awarded by the Judges in cases of pre-eminent merit only. Selected exhibits of such a nature as to require practical trials which cannot be carried out on the spot, are submitted to such trials upon the Exhibitors defraying the necessary expenses.

The Exhibits are arranged in the following Classes:—

CLASS I.—Building Materials, Construction and Machinery.

- Materials and Construction.
- Damp-proof Courses.
- Paints and other Protectives.
- Wall Papers and Coverings.
- Flooring.
- Decorative Materials.
- Machinery adapted for Sanitary Purposes.
- Laundry Appliances.

CLASS II.—Water Supply and Sewerage.

- Apparatus for Water Supply.
- Filtering and Softening Water.
- Water Waste Preventors.
- Flushing and Watering.
- Sinks.
- Baths and Lavatories.
- Water Closets.
- Urinals.
- Drain Pipes.
- Traps.
- Dry Closets.
- Sewage Treatment.
- Miscellaneous Sanitary Goods.

CLASS III.—Heating, Lighting, and Ventilating.

- Heating Apparatus.
- Cooking Apparatus.
- Smoke Preventing Appliances.
- Lighting, including Electric Lighting.
- Ventilating Gas Burners.
- Ventilators.

CLASS IV.—Personal Hygiene, Foods, Filters & Disinfectants.

- Clothing.
- Beds and other Furniture.
- Hospital and Sick Room Appliances.
- Domestic Appliances.
- School Fittings.
- Gymnastic Apparatus.
- Foods.
- Domestic Filters,
- Mineral Waters.
- Soaps and other Detergents.
- Antiseptics and Disinfectants.
- Disinfecting Apparatus.

CLASS V.—Miscellaneous.

Articles of Sanitary interest not included in the above Classes, such as:—

- Scientific Instruments.
- Books and Periodicals.
- Models and Drawings.
- Prevention of Accidents.
- Respirators and Face Guards for Unhealthy Occupations.
- Fire-preventing Appliances.
- Methods for the Disposal of the Dead, &c., &c., &c.

EXHIBITIONS HELD IN CONNECTION WITH THE CONGRESSES OF THE INSTITUTE.

	1877. Leamington.	1878. Stafford.	1879. Croydon.	1880. Exeter.	1882. Newcastle.	1883. Glasgow.	1884. Dublin.	1885. Leicester.	1886. York.
Number of Exhibitors	117	116	189	106	110	126	134	135	130
Number of Exhibits	294	319	710	500	600	750	900	1,000	900
Space occupied (in square ft.)	......	......	......	9,725	14,520	20,000	40,000	30,000	30,000
Number of days Exhibition was open	14	16	17	19	25	25	19	17	23
Total number of Visitors	......	......	......	8,955	8,373	20,000	35,000	37,000	30,000
Number of Medals awarded	13	13	12	12	15	21	17	29	11*
Number of Special Certificates	None.	6	9	7	4	13	11	11	11
Number of Certificates	None.	21	38	40	72	58	84	81	56*
Number of Exhibits deferred for further trial	......	7	52	30	37	44	39	119	42

* These do not include any awards which may be given for Deferred for further practical trial Exhibits.

CLASSIFIED LIST OF MEDALS AWARDED AT THE EXHIBITIONS.

RICHARDSON MEDAL.

Siemens's Regenerative Gas Burner. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Griffiths' Patent White. Silicate Paint Company, *Cannon Street, E.C.* STAFFORD, 1878.

Swann's Incandescent Electric Lamps. J. Edmundson & Co., *Dublin.* DUBLIN, 1884.

SILVER MEDAL.

Offered by the Exeter Gas Company.

Large Gas Cooking Stove with Boiler. The General Gas Heating and Lighting Co., 66, *St. Paul Street, N.* LEICESTER, 1885.

Fibre Asbestos Open Gas Fire. H. & C. Davis & Co., 200, *Camberwell Road, S.E.* LEICESTER, 1885.

Dr. Bond's Euthermic Ventilating Gas Stove. Sanitary & Economic Supply Association, *Gloucester.* EXETER, 1880.

Eureka Gas Cooking Stove. J. Wright & Co., *Birmingham.* DUBLIN, 1884.

SILVER MEDALS OFFERED BY THE GAS DEPARTMENT OF THE CORPORATION OF LEICESTER.

Large Gas Cooking Stove with Boiler. Thomas Fletcher, *Thynne Street, Warrington.* LEICESTER, 1885.

Eureka Artisan Gas Cooking Stove. J. Wright & Co., *Broad Street, Birmingham.* LEICESTER, 1885.

Fibre Asbestos Open Gas Fire. The General Gas Heating and Lighting Co., 66, *St. Paul Street, N.* LEICESTER, 1885.

MEDALS AND SPECIAL CERTIFICATES.

In cases where awards are made at subsequent Exhibitions for the same Exhibits, only the name of the town and date are given. Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from awards of Medals; but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following list by asterisks placed against the name of the town at which the Exhibition was held.

CLASS I.—BUILDING MATERIALS, CONSTRUCTION AND MACHINERY.

(1). Materials and Construction.

Aluminium Crown Metal. Aluminium Crown Metal Co., *Glasgow.* GLASGOW, 1883.

Delta Metal. Alex. Dick, *London.* GLASGOW, 1883.

Dœker Portable Hospital. Dœker Hospitals and Huts Factory, *London.* YORK, 1886.

Artistic Domestic Iron Work, Elgood Bros., *Leicester.* LEICESTER, 1885.

Barrow Blue Lias Hydraulic Lime. J. Ellis & Sons, *Barrow-on-Soar.* LEICESTER, 1885.

Cotton Machine Belting. Maurice Gandy, *Liverpool.* DUBLIN, 1884.

Opener for Fanlights and Skylights. W. & R. Leggott, *Bradford.* LEICESTER, 1885. *YORK, 1886.

Silicate Cotton (Slag-wool). J. A. G. Ross, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Scottish Asbestos. Scottish Asbestos Co., *Glasgow.* GLASGOW, 1883.

Victoria Artificial Stone Paving. Victoria Stone Co., *London.* LEICESTER, 1885.

Willesden Paper Roofing. Waterproof Paper and Canvas Company, *London.* YORK, 1886.

Damp-proof Concrete Pavement. W. B. Wilkinson & Co. *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Silica Glazed and Enamelled Fire Clay Bricks and Fäience. Willcocks & Co., *Burmantofts, Leeds.* CROYDON, 1879.

(2). Damp-Proof Courses.

No awards.

(3). Paints and other Protectives.

Griffiths' Patent White, and for their preparations of Silicate Paint, Enamel Paint, and Petrifying Liquid. Silicate Paint Company, *Cannon Street, E.C.* STAFFORD, 1878.

Leadless "Charlton White" Paint and Dryers. J. B. Orr & Co., *Charlton, London.* GLASGOW, 1883.

Arcanum Process of Silver Plating Steel. Jefferson Read, *Birmingham.* CROYDON, 1879.

(4). Wall Papers and Coverings.

Paper Hangings free from Arsenic. Woollams & Co., *High Street, Marylebone, London.* CROYDON, 1879. *NEWCASTLE, 1882. *GLASGOW, 1883.

(5). Flooring.

Peto Fireproof Flooring. Doulton & Co., *Lambeth.* LEICESTER, 1885.

Economic Hollow Flooring. G. E. Pritchett, 20, *Spring Gardens, London, S.W.* STAFFORD, 1878. *CROYDON, 1879.

(6). Decorative Materials.

Art Pottery. Doulton & Co., *London.* DUBLIN, 1884. *LEICESTER, 1885.

Moulded Wood Decoration. J. F. & G. Harris, *London.* YORK, 1886.

Wedgwood Ornamental Tiles. W. B. Morrison, *Glasgow.* GLASGOW, 1883.

Embossed Tiles. E. Smith & Co. LEICESTER, 1885.

Colouring Patterns through the Substance of Wood. H. Chalk Webb, *Worcester.* EXETER, 1880.

(7.) Machinery adapted for Sanitary Purposes.

Improved Six-Ton Steam Road Roller. Aveling & Porter, *Rochester,* CROYDON, 1879.

Faija's Cement Testing Machine. Casebourne & Co., *West Hartlepool.* YORK, 1886.

Fryer's Destructor, Fryer's Carbonizer, and Firman's Desiccating and Rendering Apparatus. Manlove, Alliott, Fryer & Co., *Nottingham.* NEWCASTLE, 1882.

(8). Laundry Appliances.

Improved Washer, with table complete. J. Borwell, *Britannia Foundry, Burton-on-Trent.* LEAMINGTON, 1877.

New "Shuttle" Steam Power Washing Machine. T. Bradford & Co., *London and Manchester.* LEAMINGTON, 1877. *STAFFORD, 1878.

Washing Machines. Thomas Bradford & Co., *London and Manchester.* NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.

Steam Washer. J. Greenall, *Manchester.* LEICESTER, 1885. *YORK, 1886.

Equipoise Wringing and Mangling Machine. E. N. Kenworthy & Co., *Oldham.* YORK, 1886.

CLASS II.—WATER SUPPLY AND SEWERAGE.

(1). Apparatus for Water Supply.

Anti-percussion High Pressure Valves. Doulton & Co., *Lambeth, London.* CROYDON, 1879. *EXETER, 1880. *GLASGOW, 1883. *DUBLIN, 1884.

Anti-percussion Ball Valve. Doulton & Co., *London.* NEWCASTLE, 1882.

Improvements in Well Sinking Apparatus. Le Grand & Sutcliffe, *Bunhill Row, E.C.* LEAMINGTON, 1877. *CROYDON, 1879.

Buck's Automatic Rain-water Separator. C. G. Roberts, *Haslemere, Surrey.* NEWCASTLE, 1882. *GLASGOW, 1883.

White Enamelled Fireclay Cistern. Bourtreehill Coal Co., *Dreghorn, Ayrshire.* LEICESTER, 1885.

(2). Filtering and Softening Water.

No awards.

(3). Water Waste Preventers.

Direct Acting Valveless Waste Preventer. A. T. Bean, 5, *Cannon Row, S.W.* EXETER, 1880. *NEWCASTLE, 1882.

Siphon-action Water Waste Preventers. Shanks & Co., *Barrhead, N.B.* DUBLIN, 1884.

(4). Flushing and Watering.

No awards.

(5). Sinks.

Enamelled Fireclay Sinks. J. & M. Craig, *Kilmarnock.* DUBLIN, 1884.

(6). Baths and Lavatories.

Porcelain Bath. Joseph Cliff & Sons, *Leeds.* GLASGOW, 1883. *YORK, 1886.

Hot-Air Bath. T. Galbraith, *Crawford Square, Londonderry.* LEAMINGTON, 1877.

Concrete Bath in one piece. W. H. Lascelles, *Bunhill Row, E.C.* CROYDON, 1879. *EXETER, 1880.

Fire-Clay Enamelled Bath. John Hall & Co., *Stourbridge.* GLASGOW, 1883.

Flushing Rim Lavatory Basin and Apparatus. J. Tylor & Sons, *Newgate Street, E.C.* EXETER, 1880.

(7). Water Closets.

"Excelsior" Water Closet. D. T. Bostel, *Duke Street, Brighton.* LEAMINGTON, 1877. *STAFFORD, 1878.

Full-flush Valveless Closet. Hayward, Tyler & Co., *London.* NEWCASTLE, 1882.

"Household" Water Closet. O. D. Ward, *London.* NEWCASTLE, 1882.

" " " H. Trott, *Battersea, London.* *LEICESTER, 1885.

(8). Urinals.

No awards.

(9). Drain Pipes.

Stanford's Joints for Stoneware Pipes. Doulton & Co., *Lambeth, London.* STAFFORD, 1878. *EXETER, 1880.

Stoneware Pipes with Stanford's Joint. J. Stewart, Sen., *Glasgow.* *GLASGOW, 1883.

Acme Sewer Pipes. H. Percy Boulnois, *Portsmouth.* GLASGOW, 1883.

(10). Traps.

Exhibit of Stoneware Disconnecting Traps. J. Stewart, Sen., *Glasgow.* GLASGOW, 1883.

(11). Dry Closets.

Dry Earth Closets. British Sanitary Company, *Glasgow.* NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.

Excreta Pail (oak) with Spring Lid. B. B. Haresceugh & Co., *Bentinck Street, Leeds.* LEAMINGTON, 1877. *STAFFORD, 1878.

Dry Earth or Ashes Closet. R. R. Heap, *Manchester.* GLASGOW, 1883. *DUBLIN, 1884.

Dry Closet, suitable for Ashes or Disinfecting Powder. L. Moser, *Southampton.* EXETER, 1880.

Moule's Earth Closets. Moule's Patent Earth Closet Company, 5*a*, *Garrick Street, W.C.* STAFFORD, 1878. *CROYDON, 1879. *LEICESTER, 1885. *YORK, 1886.

Moule's Earth Closet. Wippell Bros. & Row, 231 and 232, *High Street, Exeter.* *EXETER, 1880.

Dry Earth Closet. J. Parker, *Woodstock, Oxford.* LEAMINGTON, 1877.

Portable Cinder Sifting Ash Closet, with Soil Pail. Sanitary Appliance Company, *Salford.* STAFFORD, 1878. *CROYDON, 1879. *LEICESTER, 1885. *YORK, 1886.

(12). Sewage Treatment.

No awards.

(13). Miscellaneous Sanitary Goods.

Sanitary Appliances, Exhibit of. W. P. Buchan, *Glasgow.* GLASGOW, 1883.

Sanitary and Domestic Appliances, Exhibit of. Maguire & Son, *Dublin.* DUBLIN, 1884.

Roberts's Street Orderly Bin. Sanitary and Highway Appliance Co., *Sheffield.* LEICESTER, 1885.

Roberts's Sand Distributor for 2-horse Tram-track. Sanitary and Highway Appliance Co., *Sheffield.* LEICESTER, 1885.

Sand Distributor for Roads. R. Willacy, *Preston.* LEICESTER, 1885.

(14). Cisterns.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

(1). Heating Apparatus.

Fibre Asbestos Open Gas Fire. H. C. Davis & Co., *London.* *YORK, 1886.

Ventilating Tile Stove. Doulton & Co., *Lambeth, London.* EXETER, 1880. *NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.

Horizontal Spiral Lavatory Heater. Thomas Fletcher, *Thynne Street, Warrington.* LEICESTER, 1885.
Fibre Asbestos Open Gas Fire. General Gas Heating and Lighting Co., 66, *St. Paul Street, N.* LEICESTER, 1885.
Challenge Hot-water Boiler. J. Keith, *London and Edinburgh.* GLASGOW, 1883.
Slow Combustion Stoves. Musgrave & Co., *Belfast.* DUBLIN, 1884.
Dr. Bond's Euthermic Gas Stove. Sanitary & Economic Supply Association, *Gloucester.* EXETER, 1880.
Lump Asbestos Open Gas Fire. J. Wright & Co., *Broad Street, Birmingham.* LEICESTER, 1885.

(2). Cooking Apparatus.

Apparatus for Cooking by Gas. Billing & Co., *Hatton Garden, E.C.* STAFFORD, 1878. *CROYDON, 1879.
Artisan Gas Cooking Stove. H. & C. Davis & Co., 200, *Camberwell Road, S.E.* LEICESTER, 1885.
Enamelled "Metropolitan" Gas Cooking Stove. H. C. Davis & Co., *London.* YORK, 1886.
Large Gas Cooking Stove with Boiler. Thomas Fletcher, *Thynne Street, Warrington.* LEICESTER, 1885.
Large Gas Cooking Stove with Boiler. General Gas Heating and Lighting Co., 66, *St. Paul Street, N.* LEICESTER, 1885.
Economical Cooking Range. G. H. Harris, *Bristol Street, Birmingham.* LEAMINGTON, 1877. *STAFFORD, 1878.
Phœnix Portable Range, and the Birmingham Range with Reducible Fire without Gas. Hassall & Singleton, *Birmingham.* STAFFORD, 1878.
Apparatus for Cooking by Gas. S. Leoni & Co., *Strand.* STAFFORD, 1878.
"Sine quâ non" Open and Close Fire Range. A. Shaw & Son, *Glasgow.* GLASGOW, 1883.
Crabtree's Kitchen Range. E. & J. M. Verity, *Leeds.* LEICESTER, 1885.
Crabtree Kitchen Range. E. Foulds, *Leeds.* *YORK, 1886.
Artisan Cooking Range. Walker, Turnbull & Co., *Falkirk.* GLASGOW, 1883.
Improved Open or Close Range Kitchener. W. P. Wenham, *Church Street, Croydon.* CROYDON, 1879.
Wilson Portable Close Cooking Range. Wilson Engineering Company, *Holborn, W.C.* EXETER, 1880.
Improved Wilson Range with Steel Boiler and non-conducting Jacketing. Wilson Engineering Company, *London.* NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.
Eureka Gas Cooking Stove. J. Wright & Co., *Birmingham.* DUBLIN, 1884.
Eureka Artisan Gas Cooking Stove. J. Wright & Co., *Broad Street, Birmingham.* LEICESTER, 1885.
Cooking Range with Revolving Fire for the Prevention of Smoke. Whyte & Bradford, *Bowness.* GLASGOW, 1883.

(3). Smoke Preventing Appliances.

Mechanical Stoker. G. Sinclair, *Leith.* GLASGOW, 1883.

(4). Lighting, including Electric Lighting.

Swann's Incandescent Electric Lights. J. Edmundson & Co., *Dublin.* DUBLIN, 1884.

Prismoidal Pavement and Floor Lights. Hamilton & Co., *Leadenhall Street, E.C.* CROYDON, 1879.

Siemens's Regenerative Gas Burner. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Miners' Safety Lamp. W. Purdy, *Eastwood, Notts.* LEICESTER, 1885.

Mercury Gas Governor. James Stott & Co., *Oldham.* NEWCASTLE, 1882. *LEICESTER, 1885.

"Stott" Gas Governor. A. Brown & Co., *Glasgow.* *GLASGOW, 1883.

Stott's Mercury Gas Governor. Smallman, John L., *Dublin.* *DUBLIN, 1884.

Incandescent Electric Lamp. Woodhouse & Rawson, *London.* LEICESTER, 1885. *YORK, 1886.

Magnetic Cut Out for Electric Lighting. Woodhouse & Rawson Electric Supply Company of Great Britain, *Bradford.* YORK, 1886.

(5). Ventilating Gas Burners.

Wenham's Ventilating Gas Lamp. Wenham's Patent Gas Lamp Co., *London.* DUBLIN, 1884.

(6). Ventilators.

Blackman Air Propeller. F. Ashwell, *Leicester.* LEICESTER, 1885.

Conical Ventilators. J. E. Ellison, *Leeds.* STAFFORD, 1878. *CROYDON, 1879. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.

Auto-Pneumatic Ventilation. Nathan Hunt, *Bristol.* EXETER, 1880.

Glass Louvre Ventilators. J. Moore, *St. James' Walk, Clerkenwell. E.C.* EXETER, 1880.

CLASS IV. — PERSONAL HYGIENE, FOODS, FILTERS AND DISINFECTANTS.

(1). Clothing.

Innocuously-dyed Woollen Goods. Donegal Industrial Fund. DUBLIN, 1884.

Sanitary Clothing. Dr. Jaeger's Sanitary Woollen System Co., *London.* YORK, 1886.

Exhibit of Sanitary Clothing. E. Ward & Co., *Bradford,* YORK, 1886.

(2). Beds and other Furniture.

Excelsior Spring Mattress. Chorlton & Dugdale, *Manchester.* LEAMINGTON, 1877. *STAFFORD, 1878. *CROYDON, 1879. *EXETER, 1880. *NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.

"Swing" Woven Wire Mattress. Chorlton & Dugdale, *Manchester.* DUBLIN, 1884.

"Universal" Invalid Tubular Water and Air Bed. Pocock Bros., *Southwark Bridge Road.* STAFFORD, 1878. *CROYDON, 1879.

Furniture, Exhibit of. Pim Bros., *Dublin.* DUBLIN, 1884.

(3). Hospital and Sick Room Appliances.

Invalid Furniture. J. Carter, 6*a*, *Cavendish Street, W.* EXETER, 1880.

Hospital and Sick Room Appliances, Exhibit of. W. B. Hilliard & Sons, *Glasgow.* GLASGOW, 1883.

Ambulance Wheeled Litter. Maj. F. Duncan, *The Common, Woolwich.* STAFFORD, 1878.

(4). Domestic Appliances.

Exhibit of Dairy Appliances. Aylesbury Dairy Company, *London.* YORK, 1886.

Machine for Washing and Cooling Butter. F. & C. Hancock, *Dudley, Worcestershire.* LEAMINGTON, 1877. *STAFFORD, 1878.

Exhibit of Machines for Domestic use. F. & C. Hancock, *Dudley, Worcestershire.* GLASGOW, 1883. *LEICESTER, 1885. *YORK, 1886.

Ornamental Domestic Appliances. W. F. Johnson, *Leicester.* LEICESTER, 1885.

Flat Webb Knitting Machine, and Rothwell Knitting Machines, W. Rothwell, *Bolton.* DUBLIN, 1884.

Friction Driving Attachment, for Sewing Machines. Singer Manufacturing Company, *London.* GLASGOW, 1883.

Dairy Appliances, Exhibit of. Vipan & Headly, *Leicester.* LEICESTER, 1885.

Wickerwork and Brushes. Wilberforce School for the Blind, *York.* YORK, 1886.

(5). School Fittings.

School Furniture. Colman & Glendenning, *Norwich.* EXETER, 1880.

(6). Gymnastic Apparatus.

Bicycles and Tricycles, Exhibit of. Humber & Co., *Nottingham.* LEICESTER, 1885.

Cruising Canoe. R. J. Turk, *Kingston-on-Thames.* LEICESTER, 1885.

(7). Foods.

Powders for Peptonizing Milk. Burroughs, Wellcome & Co., *London.* DUBLIN, 1884.

(8). Domestic Filters.

Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.*
CROYDON, 1879. *EXETER, 1880. *GLASGOW, 1883.
*DUBLIN, 1884. *LEICESTER, 1885.
Bischof's Spongy Iron Filter. Spongy Iron Water Purifying Company, *Oxford Street, W.C.* LEAMINGTON, 1877.

(9). Mineral Waters.

10). Soaps and other Detergents.

No awards.

(11). Antiseptics and Disinfectants.

Calvert's Carbolic Acid for Disinfecting purposes. Calvert & Co., *Bradford, Manchester.* LEAMINGTON, 1877. *CROYDON, 1879.
*EXETER, 1880. *GLASGOW, 1883. *DUBLIN, 1884.
*LEICESTER, 1885. *YORK, 1886.
Jeyes' Perfect Purifier. Jeyes' Sanitary Compounds Co., *London.*
LEICESTER, 1885.
Strype's Process for Drying Blood. Dublin and Wicklow Manure Co., *Dublin.* DUBLIN, 1884.
Chemical Substances used for Disinfection. Mackey, Mackey & Co., *London.* DUBLIN, 1884.
Little's Soluble Phenyle. Morris, Little & Co., *Doncaster,*
STAFFORD, 1878.
Antiseptic Preparations, Exhibit of. J. Richardson & Co., *Leicester.*
LEICESTER, 1885.
Sanitas Oil. Sanitas Company (Limited), *London.* NEWCASTLE, 1882.
Chemical Preparations and Apparatus. Société Française D'Hygiène, *Paris.* LEAMINGTON, 1877.

(12). Disinfecting Apparatus.

Portable Disinfecting Apparatus. Fraser Bros., *Commercial Road, E.*
CROYDON, 1879.
Steam Disinfector. J. W. Lyon, *London.*
LEICESTER, 1885. *YORK, 1886.
Acid Pump and Syphon. Chas. W. Walker, *Wandsworth Common.*
CROYDON, 1879.

CLASS V.—MISCELLANEOUS.

Articles of Sanitary Interest not included in the above Classes, such as :—

(1). Scientific Instruments

No awards.

(2). Books and Periodicals.

Books on Hygiène. Société Francaise d'Hygiène, *Paris.*
NEWCASTLE, 1882.

Sanitary Engineer of New York, Newspaper. H. C. Meyer, *New York.*
GLASGOW, 1883.

(3). Models and Drawings.

No awards.

(4). Prevention of Accidents.

"Kredemnon" Life-saving Garments. F. Wentworth & Co., *London.*
GLASGOW, 1883.

(5). Respirators and Face Guards for Unhealthy Occupations.

Tyndall's Smoke Respirator. J. Sinclair, *Leadenhall Street, E.C.*
CROYDON, 1879.

(6). Fire Preventing Appliances.

(7). Methods for the Disposal of the Dead.

(8.) Sundries.

No awards.

CERTIFICATES AWARDED AT THE EXHIBITIONS.

CLASS I.—BUILDING MATERIALS, CONSTRUCTION AND MACHINERY.

(1). Materials and Construction.

Adjustable Shoe and Regulating Spring Hinge for Swinging Doors. R. Adams, 7, *Great Dover Street, London, S.E.* CROYDON, 1879.
Fanlight Openers and Casement Fasteners. R. Adams, 7, *Great Dover Street, London, S.E.* CROYDON, 1879.
Norton Door Spring. R. Adams, *London.* DUBLIN, 1884.
Adjustable Pivot for Fanlights. R. Adams, *London.* DUBLIN, 1884.
"Victor" Spring Hinge. R. Adams, *London.* LEICESTER, 1885.
Side Gussets for Fanlights. R. Adams, *London.* LEICESTER, 1885.
Steel Wheel for Sanitary Carts. H. J. Barrett, *Hull.* YORK, 1886.
White Enamelled Bricks. Bourtreehill Coal Co., *Dreghorn, Ayrshire.* DUBLIN, 1884.
White Glazed Facing Bricks. Broad & Co., *Paddington.* LEICESTER, 1885.
Granite Vitrified Bricks and Paving. Candy & Co., *Newton Abbot.* EXETER, 1880.
Willesden Waterpoof Paper and Canvas. W. Carson & Sons, *Dublin.* DUBLIN, 1884.
Granite Concrete Pavement. T. Cordingley & Sons, *Bradford,* DUBLIN, 1884.
White Enamelled Bricks. J. & M. Craig, *Kilmarnock.* DUBLIN, 1884.
The Croft Artificial Stone Paving. Croft Stone Quarry & Brick Co., *Croft, Leicestershire.* LEICESTER, 1885.
Silicon Tread For Steps. Doulton & Co., *Lambeth, London.* GLASGOW, 1883. DUBLIN, 1884. LEICESTER, 1885.
Cotton Machine Belting. M. Gandy, *Liverpool.* GLASGOW, 1883.
Steil's Fastener for Machine Belting. M. Gandy, *Liverpool.* GLASGOW, 1883.
Acme Door Check and Spring (double action). Hindle Norton & Co., *Oldham.* YORK, 1886.
Opener for Fanlights and Skylights. W. & R. Leggott, *Bradford.* GLASGOW, 1883. DUBLIN, 1884.
Glazing without Putty. Pennycook Patent Glazing & Engineering Company, *Glasgow.* GLASGOW, 1883. DUBLIN, 1884.
Revolving Shutters, with Balance Weight Motion. Salmon, Barnes & Co., *Ulverston.* EXETER, 1880.
Red Building Bricks. E. Smith & Co., *Coalville.* LEICESTER, 1885.
Vitreous Floor Tiles. E. Smith & Co., *Coalville.* YORK, 1886.
Hygeian Rock Building Composition. William White, *Abergavenny.* NEWCASTLE, 1882.
Terra Cotta, Exhibit of. Whitwick Colliery Co., *Coalville, Leicester.* LEICESTER, 1885.

Chain Belting for Machinery. W. Wilby, *Dublin.* DUBLIN, 1884.

Red Building Bricks. Whitwick Colliery Co., *Coalville, Leicester.* LEICESTER, 1885.

Salt-Glazed Bricks. Wortley Fire Clay Company, *Leeds.* YORK, 1886.

Fireproof Fixing Blocks. Wright & Co., *London.* YORK, 1886.

White and Coloured Glazed Bricks. Wortley Fire Clay Company, *Leeds.* YORK, 1886.

(2). Damp Proof Courses.

(3). Paints and other Protectives.

No awards.

(4). Wall Papers and Coverings.

"Lincrusta Walton." F. Walton & Co., *London.* GLASGOW, 1883.

Cheap Artistic Non-Arsenical Washable Wall Papers. Thomas Dockrell, Sons & Co., *Dublin.* DUBLIN, 1884.

(5). Flooring.

Immovable "Acme" System of Solid Wood Block Flooring. Duffy & Son, *London.* YORK, 1886.

Parquet Flooring. A. Gardner & Son, *Glasgow.* GLASGOW, 1883.

Hospital Flooring. T. Jennings, *Lambeth.* LEICESTER, 1885.

Method of Wood Block Flooring. Nightingale & Co., *Great Grimsby.* LEICESTER, 1885. YORK, 1886.

Solid Oak Parquet Flooring. F. R. Scott & Co., *Dublin.* DUBLIN, 1884.

(6). Decorative Materials.

Hall's Hanging Tiles. J. Cliff & Sons, *Leeds.* YORK, 1886.

Improved Fibrous Plaster Work. Cordingley & Son, *Bradford.* YORK, 1886.

Decorative Tiles for Covering Walls and Floors. Doulton & Co., *Lambeth, London.* CROYDON, 1879.

Marsden Tiling for Wall Decoration. Maguire & Son, *Dublin.* DUBLIN, 1884.

Repoussé and other Brass Work, Exhibit of. W. F. Johnson, *Leicester.* LEICESTER, 1885.

Photographic Embossed and Incised Tiles. E. Smith & Co., *Coalville, Leicester.* LEICESTER, 1885.

Architectural Terra Cotta, Exhibit of. J. Stiff & Sons, *Lambeth.* LEICESTER, 1885.

(7). Machinery adapted for Sanitary Purposes.

Improved Non-Absorbent Tub or Pail Van. J. B. McCallum, *Stafford.* EXETER, 1880.

(8). Laundry Appliances.

White Enamelled Fireclay Laundry Trough. Bourtreehill Coal Co., *Dreghorn, Ayrshire.* DUBLIN, 1884.
Washing Machine, Heated by Gas. Thomas Fletcher, *Warrington.* LEICESTER, 1885.
"Vowel E." Bradford's Family Washing Machine. Garton & King, *Exeter.* EXETER, 1880.
Paragon Washing Machine with Canadian Washer. E. N. Kenworthy & Co., *Oldham.* LEICESTER, 1885. YORK, 1886.
Paragon Washing Machine with Canadian Washer. Kirsop & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Mitchell's Patent Steam Washer. James Mitchell, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

CLASS II.—WATER SUPPLY AND SEWERAGE.

(1). Apparatus for Water Supply.

Hydraulic Ram. W. Baird, *Dublin.* DUBLIN, 1884.
Latham's Flap Valve. Doulton & Co., *London.* NEWCASTLE, 1882.
Water-taps. J. Fell & Co., *Wolverhampton.* NEWCASTLE, 1882.
Large Way Waste Plug, with Protective Cover. Finch & Co., 181, *High Holborn, W.C.* CROYDON, 1879.
Double Valves for Flow and Return in Hot-water Circulation. Goode & Co., *Loughborough.* LEICESTER, 1885.
Hose Reel. Headley & Sons, *Cambridge.* CROYDON, 1879.
Improved Paragon Valve. W. Ross, *Glasgow.* GLASGOW, 1883.
Bib Valves for Hot and Cold Water. H. Trott, *Battersea.* LEICESTER, 1885. YORK, 1886.
Improved Full-Way Stop Valve. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880.
Vacuum Flushing Cistern for Closet, with Seat-action Arrangement. Doulton & Co., *Lambeth, London.* DUBLIN, 1884.
Anti-percussion High-pressure Bib Valves. Doulton & Co., *London,* NEWCASTLE, 1882.
Lever Nut for Boiler Cock. J. Warner & Son, *London.* LEICESTER, 1885.

(2). Filtering and Softening Water.

Anti-Calcaire Powders for Softening Water. P. A. Maignen, *London.* GLASGOW, 1883.
Porous Carbon for Filtering Water. Patent Porous Carbon Co., *London.* LEICESTER, 1885.

(3). Water Waste Preventers.

Waste-preventing Flushing Syphon. Henry Watson & Son, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Siphon for Water Closet Cisterns. Braithwaite & Co., *Leeds.* CROYDON, 1879.

Siphon Action Water-waste Preventer. H. Braithwaite & Co., *Leeds.* YORK, 1886.

Bath Locking Valves, for preventing Waste of Water. Doulton & Co., *Lambeth, London.* NEWCASTLE, 1882.

"Waste Not" Regulator Valve. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880. NEWCASTLE, 1882.

Bath Locking Valves for preventing Waste of Water. J. Tylor & Sons, *London.* NEWCASTLE, 1882.

(4). Flushing and Watering.

Combined Flush-tank and Grease Interceptor. Adams & Co., *York.* YORK, 1886.

"Invicta" Flushing Cistern. Goode & Co., *Loughborough.* LEICESTER, 1885.

Siphon Flushing Cistern. F. Humpherson, *Chelsea, London.* LEICESTER, 1885.

Siphon Flushing Cistern. Wright & Stevens. NEWCASTLE, 1882.

(5). Sinks.

Butler's Sink, lined with Block Tin. W. Baird, *Dublin.* DUBLIN, 1884.

White Enamelled Fireclay Sinks. W. Baird, *Dublin.* DUBLIN, 1884.

White Enamelled Fireclay Sinks. Bourtreehill Coal Co., *Dreghorn, Ayrshire.* DUBLIN, 1884. LEICESTER, 1885.

White Enamelled Fire Clay Sinks. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882. GLASGOW, 1883.

White Enamelled Sinks. J. Cliff & Sons, *Leeds.* YORK, 1886.

"Imperial" Slop Sink. J. Cliff & Sons, *Leeds.* YORK, 1886.

Cheap Glazed Stoneware Sinks. Doulton & Co., *Lambeth, London.* DUBLIN, 1884.

"Artisans' Dwellings Sink." G. Jennings, *Stangate, London.* CROYDON, 1879.

White Enamelled Fireclay Sinks. Maguire & Son, *Dublin.* DUBLIN, 1884.

Swivel, Lock Plug, and Overflow for Sinks. Stidder & Co., 50, *Southwark Bridge Road, S.E.* CROYDON, 1879.

Cup Grating for Sinks. Thomasson & Key, *Worcester.* NEWCASTLE, 1882.

Improved Enamelled Iron Slop Sink, with Regulator Supply Valve. J. Tylor & Sons, 2, *Newgate Street, London, E.C.* EXETER, 1880.

Hospital Slop Sink with Waste-not Regulator Valve. J. Tylor & Sons, *London.* NEWCASTLE, 1882.

Slop Sinks. T. Twyford, *Hanley.* DUBLIN, 1884.

Fire-Clay Sanitary Sinks, and Water Troughs. Willcock & Co., *Burmantofts, Leeds.* CROYDON, 1879.

White Enamelled Sinks. Wortley Fire Clay Company, *Leeds.* YORK, 1886.

(6). Baths and Lavatories.

Bath, with Shower Douche and Spray Fittings combined. W. Baird, *Dublin.* DUBLIN, 1884.

Lavatory, with Shampooing Apparatus. W. Baird, *Dublin.* DUBLIN, 1884.

Improved Horizontal-Pull Fittings to Baths and Lavatories. W. Baird, *Dublin.* DUBLIN, 1884.

Jennings's Universal Shampooing Apparatus. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Locking Apparatus for Bath Fittings. Doulton & Co,, *Lambeth, London.* DUBLIN, 1884.

Tip-up Lavatory Basin. Doulton & Co., *London.* NEWCASTLE, 1882.

Clark's Anti-splash Tip-up Lavatory Basin. J. Fell & Co., *Wolverhampton.* NEWCASTLE, 1882.

"Shanks's" Porcelain Lavatory Fittings. Fergusson & Starkey, *Leicester.* LEICESTER, 1885.

Shanks's "Eureka" Spray and Plunge Bath. Fergusson & Starkey, *Leicester.* LEICESTER, 1885.

"Unbreakable" Fire-clay Lavatory Basins for Schools, &c. Fergusson & Starkey, *Leicester.* LEICESTER, 1885.

Lavatory. Gillow & Co., *Oxford Street, W.* STAFFORD, 1878.

Well and Dry-Platform Sponge Bath. Groom & Co., *London.* LEICESTER, 1885.

Shower and Douche Bracket. Hayward, Tyler & Co., *London.* NEWCASTLE, 1882.

"Universal" Shampooing Apparatus. G. Jennings, *Stangate, London.* CROYDON, 1879.

Lavatory Basin with Flushing Rim. C. T. Maling, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Enamelled Fire Clay Bath. Rimington Bros. & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Porcelain Baths, moulded and glazed in one piece. Ruffard & Co., *Clay Works, Stourbridge.* STAFFORD, 1878.

Cast Iron Bath. Shanks & Co., *Glasgow.* GLASGOW, 1883. DUBLIN, 1884.

Porcelain Lavatories, with moveable caps for access to fittings. Shanks & Co., *Glasgow.* GLASGOW, 1883. DUBLIN, 1884.

"Eureka" Spray and Plunge Bath. Shanks & Co. *Glasgow.* GLASGOW, 1883.

Lavatory Basins. T. Twyford, *Hanley.* DUBLIN, 1884.

Flushing Rim Lavatory Basin with Quick Waste. J. Tylor & Sons, *London.* NEWCASTLE, 1882.

(7). Water Closets.

Improved Shape of Trough for Water Closets. Adams & Co., *York.* LEICESTER, 1885.

Artisan Closet. Beard, Dent & Hellyer, 21, *Newcastle Street, London, W.C.* CROYDON, 1879.

Economical Flush-Out Closet. Doulton & Co., *Lambeth*, *London.*
EXETER, 1880. NEWCASTLE, 1882.

"Lambeth" Flush-out Closet. Doulton & Co., *Lambeth*, *London.*
GLASGOW, 1883.

"Lambeth" Trough Closet with Automatic Flush Tank. Doulton & Co., *Lambeth*, *London.* GLASGOW, 1883.

Lambeth Combination Water Closet. Doulton & Co., *Lambeth*, *London.* DUBLIN, 1884.

Economical Combination Closet in two pieces. Doulton & Co., *London.* LEICESTER, 1885.

Improved Seat for Water Closets. E. & A. E. Gilbert, *Broughty Ferry*, *Forfarshire.* GLASGOW, 1883.

Fowler's Water-closet. W. Harriman & Co., *Blaydon-upon-Tyne.*
NEWCASTLE, 1882.

"Beaufort" Flush-down Closet. F. Humpherson, *London.*
LEICESTER, 1885.

Wilcock's Automatic Flushing Closet. Maguire & Son, *Dublin.*
DUBLIN, 1884.

"National" Water Closet. W. B. Morrison, *Glasgow.*
GLASGOW, 1883.

"Clear Way" Regulator Valve Water Closet, without overflow communicating with Valve Box. J. Tylor & Sons, 2, *Newgate Street*, *London*, *E.C.* EXETER, 1880.

Terry's Pedal-action for Water Closets. J. Tylor & Sons, *London.*
NEWCASTLE, 1882.

"National" Water Closet. Henry Watson & Son, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

"Crown" Cottage Water Closet. Henry Watson & Son, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

(8). Urinals.

Flush-out Urinal Basin. J. Tylor & Sons, *Newgate Street*, *London.*
NEWCASTLE, 1882.

(9). Drain Pipes.

Large Fire-clay Drain Pipes. Straker & Love, *Newcastle-upon-Tyne.*
NEWCASTLE, 1882.

Stoneware Pipes. Branksea Island Pottery Company (Limited), *Poole*, *Dorset.* EXETER, 1880.

Improved Drain Pipe with Access Cover. W. P. Buchan, *Glasgow.*
NEWCASTLE, 1882.

Salt-glazed Fire-clay Sewer Pipes, Exhibit of. J. Binnie, *Gartcosh*, *Glasgow.* GLASGOW, 1883.

Stoneware Drain Pipes. Bourtreehill Coal Co., *Dreghorn*, *Ayrshire.*
DUBLIN, 1884.

London-made Stoneware Pipes. Doulton & Co., *Lambeth*, *London.*
DUBLIN, 1884.

Cast-iron Drain Pipes, coated with Angus Smith's Preparation. Maguire & Son, *Dublin.* DUBLIN, 1884.

Maguire's Cradle Joint for Drain Pipes. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882.
Cast Iron Channels for Stable Drainage. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Joint for Drain Pipes. Doulton & Co., *London.* NEWCASTLE, 1882.
Artificial Stone Tubes. Patent Victoria Stone Company, *Kingsland Road, London, E.* CROYDON, 1879.
Rock Concrete Tubes. Sharpe, Jones & Co., *Bourne Valley Pottery. Poole, Dorset.* CROYDON, 1879.
Mawbey's Joint for Stoneware Pipes. T. Wragg & Sons, *Burton-on-Trent.* LEICESTER, 1885. YORK, 1886.

(10). Traps.

Potts' Edinburgh Sewer Trap. Adams & Co., *York.* LEICESTER, 1885.
Simplex Reversible Gully. J. Cliff & Sons, *Leeds.* YORK, 1886.
Ventilating Drain Syphon. Beard, Dent & Hellyer, 21, *Newcastle Street, W.C.* CROYDON, 1879.
White Enamelled Fire-clay Gullies. Broad & Co., *Paddington.* LEICESTER, 1885.
Disconnecting Drain Trap. W. P. Buchan, *Glasgow.* NEWCASTLE, 1882. GLASGOW, 1883.
Grease Trap for Kitchen Sinks. W. P. Buchan, *Glasgow.* GLASGOW, 1883.
Buchan's Disconnecting Trap. J. & M. Craig, *Kilmarnock.* EXETER, 1880. DUBLIN, 1884.
Buchan's Disconnecting Drain Trap and Drain Pipes, with Access Cover. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882.
Exhibit of Stoneware Disconnecting Traps. J. & M. Craig, *Kilmarnock.* GLASGOW, 1883.
Disconnecting Gully, with back and side Entrances and iron grating. Doulton & Co., *Lambeth, London.* CROYDON, 1879.
Reversible Inlet Gully, with Dished Stoneware Cover and Iron Grating. Doulton & Co., *London.* NEWCASTLE, 1882.
Dean's External Drain Traps, with moveable receptacle. J. C. Edwards, *Trefynant, Ruabon.* CROYDON, 1879.
Gordon's Disconnecting Trap. J. J. Ellis, *Ellistown Collieries.* LEICESTER, 1885.
Smith's Cast Lead Syphon Traps. J. Fell & Co., *Wolverhampton.* NEWCASTLE, 1882.
Morris's Cast Iron Gulley, with moveable Dip Pipe. Foster & Pearson, *Nottingham.* LEICESTER, 1885.
Hornibrook's Catchment Grating for Steep Gradients. Hammond & Hussey, *High Street, Croydon.* CROYDON, 1879.
"Eagle" Sanitary Trap, for superseding Bell Traps. Hygienic Stove and Grate Company, 15, *Peel Buildings, Birmingham.* CROYDON, 1879.
Edinburgh Air-Chambered Sewer Trap. Potts & Co., *Handsworth, Birmingham.* STAFFORD, 1878.

Dean's Gully Trap. Rimington Bros. & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Disconnecting Chamber for House Drains, with open Stoneware Channels. J. Stewart, Sen., *Glasgow.* GLASGOW, 1883.

Weaver's Ventilating Sewer Air Trap. James Stiff & Sons, *Lambeth, London.* STAFFORD, 1878. LEICESTER, 1885.

Simpson's Street Gully. Wortley Fire Clay Company, *Leeds.* YORK, 1886.

Gordon's Disconnecting Trap. T. Wragg & Sons, *Burton-on-Trent.* LEICESTER, 1885.

(11). Dry Closets.

Self-Acting Earth Closet. British Sanitary Company, *Glasgow.* EXETER, 1880.

Moser's Self-Acting Dry Closet. J. C. Onions (Limited), *Birmingham.* CROYDON, 1879.

Dry Earth Commode without Separator. J. Parker, *Woodstock.* EXETER, 1880.

(12). Sewage Treatment.

Iron Basket Sewage-strainer. T. Harnett Harrisson, *Liverpool.* GLASGOW, 1883.

Pneumatic Liquid Ejector. Isaac Shone, *Wrexham.* STAFFORD, 1878.

(13). Miscellaneous Sanitary Goods.

Air-tight Man-hole Door. A. T. Angell, *London.* NEWCASTLE, 1882. GLASGOW, 1883.

Woodman's Stoneware Screw Plug and Collar, for access to Drains. Bailey & Co., *London.* YORK, 1886.

Watts's Asphyxiator for Testing Drains with Smoke. Baird, Thompson & Co., *Glasgow.* DUBLIN, 1884.

White Enamelled Straight and Curved Channels for Inspection Chambers to Drains. Broad & Co., *Paddington.* LEICESTER, 1885.

"Eclipse" Apparatus for Testing Drain and other Pipes. Burn & Baillie, *London.* YORK, 1886.

Galvanized Cast-iron Air-tight Inspection Chamber and Drain Pipes. Burn & Baillie, *London.* YORK, 1886.

Brian Jones's Joint for connecting Closet with Soil-pipe. Capper, Son & Co., *London.* NEWCASTLE, 1882.

White Enamelled Urinal Floor Channel. J. Cliff & Sons, *Leeds.* YORK, 1886.

Indiarubber Expanding Plug for Drain Testing. Burn & Baillie, *London.* YORK, 1886.

Enamelled Ware Open Channels for Manholes. Doulton & Co., *Lambeth, London.* DUBLIN, 1884.

Manhole for Drains, with connections complete. Doulton & Co., *Lambeth, London.* DUBLIN, 1884.

Galvanized Iron Dust-Bin. W. F. Johnson, *Leicester.* LEICESTER, 1885.

Cold Metal Double Cone Mechanical Lead Pipe Joints. Elliott, Edminson, & Olney, *Manchester.* LEICESTER, 1885.

Improved method of connecting Lead Pipes with Stoneware Pipes. T. Harnett Harrisson, *Liverpool.* GLASGOW, 1883.

Clip Pipe Joint. Humpherson & Co., *London.* LEICESTER, 1885.

Night Soil Receptacle with Spring Lid. E. G. Kirk, *Huddersfield.* LEICESTER, 1885.

Sanitary Earthenware. C. T. Maling, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Bronte's Air-tight Cast-iron Man-hole Cover. W. Phillips & Son, *London.* YORK, 1886.

"Siphozella" Pipe Fastening. G. W. Potter, *London.* YORK, 1886.

Working Model of Cattle Drinking Trough. R. Pringle, M.D., *Blackheath.* LEICESTER, 1885.

Drain-cleaning Rods, and Stoneware Horse Manger. Oates & Green, *Horley Green Fire Clay Works, Halifax.* STAFFORD, 1878.

Roberts's Asphalte Cauldron. Sanitary & Highway Appliance Co., *Sheffield.* LEICESTER, 1885.

Closed Sectional Sanitary Van. J. Smith & Sons, *Wolverhampton.* LEICESTER, 1885.

India-Rubber Connection for joining Lead and Earthenware Pipes. T. Twyford, *Hanley.* DUBLIN, 1884.

Joint for Lead Pipes. J. Tylor & Sons, 21, *Newgate Street, London.* NEWCASTLE, 1882.

Nicholl's Hospital Pail. W. P. White & Co., *London.* YORK, 1886.

White Enamelled Straight and Curved Channels, and Channel Junctions for Inspection Chambers to Drains. Wortley Fire Clay Co., *Leeds.* LEICESTER, 1885.

Gordon's Junction Blocks for Lamp-holes and Inlets to Sewers. T. Wragg & Sons, *Burton-on-Trent.* LEICESTER, 1885.

Gordon's Ventilating Manhole Covers for Sewers with Annular Dirt Box. Wright Bros., *Leicester.* LEICESTER, 1885.

Gordon's Iron Ventilating Cover for Disconnecting Trap. Wright Bros., *Leicester.* LEICESTER, 1885.

CLASS III.—HEATING, LIGHTING AND VENTILATING.

(1). Heating Apparatus.

Gas Cooking Stove, lined with White Tiles. Arden Hill & Co., *Birmingham.* DUBLIN, 1884.

Lump Asbestos Open Gas Fire. Arden Hill & Co., *Constitution Hill, Birmingham.* LEICESTER, 1885.

Steam Kettle with specially arranged Tap for drawing Boiling Water. Frank Ashwell, *Leicester*. LEICESTER, 1885.

Silicate Cotton Composition for Covering Steam Pipes. C. Cadle, *Dublin*. DUBLIN, 1884.

Tortoise Slow Combustion Stoves. W. Carson & Sons, *Dublin*. DUBLIN, 1884.

George's Calorigen. Dinning & Cooke, *Newcastle-upon-Tyne*. NEWCASTLE, 1882.

Grates, Mantelpieces, and Over-mantels. Dinning & Cooke, *Newcastle-upon-Tyne*. NEWCASTLE, 1882.

Glazed Ware Mantelpiece, with Slow Combustion Grate. Doulton & Co., *Lambeth, London*. DUBLIN, 1884.

Marsh Greenall Regenerative Gas Heating Stove. J. Greenall, *Manchester*. YORK, 1886.

Alcazar Vertical Steam Engine. E. S. Hindley, *Bornton, Dorset*. YORK, 1886.

Tortoise Slow Combustion Stoves. Hydes & Wigfull, *Sheffield*. GLASGOW, 1883.

Tortoise Laundry Stove. Hydes & Wigfull, *Sheffield*. GLASGOW, 1883.

Laundry Stove and Copper Boiler. Maguire & Son, *Dublin*. DUBLIN, 1884.

Steam Heating Apparatus, combining heating and ventilating. Mather & Armstrong, *Newcastle-upon-Tyne*. NEWCASTLE, 1882.

Warming and Ventilating Appliances. G. E. Pritchett, 20, *Spring Gardens, London, S.W.* STAFFORD, 1878.

Corrugated Iron Hot-Water Warming Appliances. G. E. Pritchett, 20, *Spring Gardens, S.W.* EXETER, 1880.

Heating Apparatus for Small Greenhouses. T. Sharman, *Leicester*. LEICESTER, 1885.

Thermhydric Ventilating Hot-water Open Fire Grate. H. Saxon Snell, *Southampton Buildings*. STAFFORD, 1878.

Tubular-Calorifer for Greenhouses. William Thornburn, *Borough Bridge*. NEWCASTLE, 1882.

Radiating Gas Fire. Chas. Wilson & Sons, *Leeds*. YORK, 1886.

Conservatory Boiler, with Hot-Water Pipe. Wippell Bros. & Row, *Exeter*. EXETER, 1880.

"Cosey" Portable Open Gas Fire, with Platinum Wire and Asbestos Packing. John Wright & Co., *Birmingham*. NEWCASTLE, 1882.

Ventilating Open Gas Fire. J. Wright & Co., *Birmingham*. DUBLIN, 1884.

(2). Cooking Apparatus.

Solid Flame Boiling Stove. Arden Hill & Co., *Birmingham*. NEWCASTLE, 1882.

Combined Close Fire and Gas Cooking Range. Carron Co., *Falkirk*. GLASGOW, 1883.

"Sunlight Stove." Chorlton & Dugdale, 19, *Blackfriars Street, Manchester*. EXETER, 1880.

Devonshire Cooking Range. T. J. Constantine, *Fleet Street, E.C.* EXETER, 1880.

Artisan Gas Cooking Stove. General Gas Heating and Lighting Co.; 66, *St. Paul Street, N.* LEICESTER, 1885.

Tin Cooking Utensils. Mrs. A. Lewis, *Manchester.* CROYDON, 1879.

Dow's Close and Open Fire Cooking Range. W. McGeoch & Co., *Glasgow.* GLASGOW, 1883.

Simplex Cooking Range. Walker, Turnbull & Co., *Falkirk.* GLASGOW, 1883.

Cooking Stove with Warm-Air Chamber. Thos. Waller, 47, *Fish Street Hill, E.C.* CROYDON, 1879.

Cottage Range. Wippell Bros. & Row, *Exeter.* EXETER, 1880.

Large Gas Cooking Stove with Boiler. J. Wright & Co., *Broad Street, Birmingham.* LEICESTER, 1885.

Large Gas Cooking Stove. Wright & Co., *Birmingham.* YORK, 1886.

(3). Smoke Preventing Appliances.

Open Grate for consuming Smoke. James Smith, *Liverpool.* NEWCASTLE, 1882.

(4). Lighting, including Electric Lighting.

Improved Gas Burners. Bray & Co., *Blackman Lane, Leeds.* CROYDON, 1879.

Portable Gas Apparatus for Manufacturing Gas from Gasoline. F. W. Clarke's Portable Gas Apparatus Company (Limited), *Great Queen Street, London, W.C.* CROYDON, 1879.

Albo Carbon Light. William Forrest, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Albo-Carbon Light. Osbert Henderson, *Glasgow.* GLASGOW, 1883.

Duplex Burner. T. Heron, *Manchester.* NEWCASTLE, 1882.

"Rheo-meter" Street Lamp Regulator. S. Leoni & Co., *Strand, W.C.* STAFFORD, 1878.

Hink's Duplex Lamp with Extinguisher. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

"Milwaukee" Glass Lantern or Hurricane Lantern. S. E. Ransome & Co., 10, *Essex Street, W.C.* CROYDON, 1879.

Gaseliers and Gas Brackets. Willey & Co., *Exeter.* EXETER, 1880.

Chappuis Daylight Reflector. Wippell Bros. & Row, 231, *High Street, Exeter.* EXETER, 1880.

Cunningham Woodhouse & Rawson Magnetic Cut Out for Electric Lighting. Woodhouse & Rawson, *London.* LEICESTER, 1885.

Combination Plug and Metre Bridge (Davies & Moynhan's Patent). Woodhouse & Rawson Electric Supply Company of Great Britain, *Bradford.* YORK, 1886.

(5). Ventilating Gas Burners.

No awards.

(6). Ventilators.

Method of Costless Ventilation. Peter Hinckes Bird, 1, *Norfolk Square, W.* CROYDON, 1879.

Glass Revolving and Sliding Ventilators. H. W. Cooper & Co., *London.* GLASGOW, 1883.

Air Inlet Head for Drain Ventilation. H. S. Cregeen, *Bromley.* NEWCASTLE, 1882.

"Radiator" Ventilator, with Screw Action. J. E. Ellison, *Leeds.* GLASGOW, 1883. DUBLIN, 1884.

Double Current Ventilators. Hill & Hey, *Halifax.* GLASGOW, 1883.

Outlet Ventilator. C. Kite & Co., *London.* NEWCASTLE, 1882.

Noiseless Chimney Breast Outlet Ventilator. Kite & Co., *London.* GLASGOW, 1883. DUBLIN, 1884.

Wall Inlet Ventilator. C. Kite & Co., *London.* GLASGOW, 1883. DUBLIN, 1884.

Telescoped Wall Inlet Ventilator. C. Kite & Co., *London.* LEICESTER, 1885.

"Imperial" Ventilating Window. U. Knell, 77, *Fore Street, E.C.* CROYDON, 1879.

Morgan's Stench Exhaust. Nailsworth Foundry Company, *Bristol.* NEWCASTLE, 1882.

Ventilating and Warming Appliances. G. E. Pritchett, 20, *Spring Gardens, S. W.* STAFFORD, 1878.

Ransome's Artificial Stone Air Brick. Wippell Bros. & Row, 231, *High Street, Exeter.* EXETER, 1880.

Ornamental Inlet Ventilators. C. H. Sharp & Co., *High Holborn, E.C.* EXETER, 1880.

Boyle's Mica-Valved Outlet Ventilator. Wenham & Co., *Church Street, Croydon.* CROYDON, 1879.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

(1.) Clothing.

Crocodile Hide Leather. Borough Leather Warehouse Co., *London.* GLASGOW, 1883.

Ventilatorium Waterproof Garments. Bartrum, Harvey & Co., *London.* STAFFORD, 1878.

Ventilating Corsets. E. & C. Dillon, *York.* YORK, 1886.

Ventilated Hats. W. Graham, *Dublin.* DUBLIN, 1884.

Improved shape of Boot. J. Hotblack & Son, *Norwich.* DUBLIN, 1884.

Camel's Hair Clothing and Bedding. Dr. Jaeger's Sanitary Woollen System Company, *London.* YORK, 1886.

Pith Helmet. J. Morgan, *Dublin.* DUBLIN, 1884.

Rhinoceros Hide "S" Boot. Patrick Short, *Dublin.* DUBLIN, 1884.

Boot and Shoe Uppers. Staynes & Sons, *Leicester.* LEICESTER, 1885.
Furs. Brooke Tyrrell, *Dublin.* DUBLIN, 1884.
Hygeia Corset. E. Ward & Co., *Bradford.* YORK, 1886.
"Arachne" Flannel. E. Ward & Co., *Bradford.* YORK, 1886.
"Natural" Boot for Ladies. A. Webb, *Dublin.* DUBLIN, 1884.

(2). Beds and other Furniture.

Spring Mattresses. Billington Bros., *Liverpool.* GLASGOW, 1883.
Portable Bed, with Liverpool Spring Mattress. Billington Bros., *Liverpool.* DUBLIN, 1884.
Central Tube Water Mattress. Brady & Martin, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Bed Rest with Movable Arms. Willam Brock & Co., 177, *Fore Street, Exeter.* EXETER, 1880.
"Nonsuch" Adjustable Chair. Willam Brock & Co., 177, *Fore Street, Exeter.* EXETER, 1880.
Spring Mattress. Bussey & Co., *Museum Works, Peckham, S.E.* CROYDON, 1879.
"Excelsior" Ships' Berth. Chorlton & Dugdale, *Manchester.* GLASGOW, 1883.
Pitch Pine Lath Mattress. Chorlton & Dugdale, *Manchester.* DUBLIN, 1884.
Automaton Seat for Drapers. Colman & Glendenning, *Norwich.* EXETER, 1880.
Combination Bedstead. W. Fleming, *Dublin.* DUBLIN, 1884.
Spring Mattress. A. Gardner & Son, *Glasgow.* GLASGOW, 1883.
Invalid "Grasshopper" Couch. William Hamilton, *Brighton.* STAFFORD, 1878. NEWCASTLE, 1882.
Wood's Double Woven Galvanized Steel Wire Spring Mattress. Longford Wire, Iron and Steel Company, *Warrington.* YORK, 1886.
Institution Bed, with Woven-Wire Mattress. Pearson & Co., *Dublin.* DUBLIN, 1884.
Hinged Cot. Pim Bros., *Dublin.* DUBLIN, 1884.
Furniture. Scott & Co., *Dublin.* DUBLIN, 1884.
Fernby's "Paragon" Camp Furniture. Wippell Bros. & Row, *Exeter.* EXETER, 1880.

(3). Hospital and Sick Room Appliances.

Metallic Tubular Bedsteads and Invalid Bed Rests. Thomas Allen, *St. Augustine's Parade, Bristol.* STAFFORD, 1878.
Folding Invalid Bed. Ancell Ball, *Spalding.* CROYDON, 1879.
Absorbent Cotton and Antiseptic Sponges. Burroughs, Wellcome & Co., *London.* DUBLIN, 1884.
"Invalid's" Adjustable Bed. Chorlton & Dugdale, *Manchester.* EXETER, 1880.
Hospital Bed, fitted with Raising Appliances. Chorlton & Dugdale, *Manchester.* DUBLIN, 1884.

Hospital Bed, with new Spring Mattress. Chorlton & Dugdale, *Manchester.* DUBLIN, 1884.
Self-acting Sick Bed. E. K. Groves, *Bristol.* GLASGOW, 1883.
Burn and Wound Boxes. W. B. Hilliard & Sons, *Glasgow.* GLASGOW, 1883.
Isolating Curtain. W. B. Hilliard & Sons, *Glasgow* GLASGOW, 1883.
India Rubber Vessels for hospital use. H. A. Murton, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
China Cups and other Vessels for invalid use. Townsend & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Stypium Absorbent Antiseptic Surgical Dressings. Stephenson & Travis, *Liverpool.* DUBLIN, 1884.

(4). Domestic Appliances.

Butter Squeezing Machine. Aylesbury Dairy Company, *London.* YORK, 1886.
"Unique" Folding Box. T. P. Bethell, *Liverpool.* LEICESTER, 1885.
Automatic Chariot for Children. William Bowden, *London,* NEWCASTLE, 1882.
Revolving Shuttle for Sewing Machines. Bradbury & Co., *Oldham.* GLASGOW, 1883.
Black Diamond Boot and Shoe Cleaning Machine. T. Bradford & Co., *Salford.* LEICESTER, 1885.
Conical Knitting Machine. T. Coltman, *Leicester.* LEICESTER, 1885.
Electric Bells, Exhibit of. J. T. Gent & Co., *Leicester.* LEICESTER, 1885.
Compostella Fire Lights for Lighting Fires. Compostella Fire Light Company, *Fenchurch Street, E.C.* STAFFORD, 1878.
Porpoise Oil Dubbin. J. T. Dales, *London.* LEICESTER, 1885.
Bower's Potato Steamer. Groom & Co., *London.* DUBLIN, 1884.
Self-Indicating Tea or Coffee Infuser. Groom & Co., *London.* DUBLIN, 1884.
Stoneware Churns. F. Grosvenor, *Glasgow.* GLASGOW, 1883.
Dough Kneading Machine. F. & C. Hancock, *Dudley, Worcester.* EXETER, 1880.
New Propellor Churn. F. & C. Hancock, *Dudley, Worcester.* EXETER, 1880.
Machine for Washing and Peeling Potatoes. F. & C. Hancock, *Dudley.* NEWCASTLE, 1882.
New Cooker and Steamer. F. & C. Hancock, *Dudley.* YORK, 1886.
Knitting Machines. Harrison Patent Knitting Machine Co., *Manchester.* DUBLIN, 1884.
Pendulous Food Warmers. Osbert Henderson, *Glasgow.* GLASGOW, 1883.
Various Inventions for Promoting Domestic Economy. W. H. Hilton, *Leamington.* STAFFORD, 1878.
India Rubber Gas Tubing. A. Hutchinson & Co., *Great Winchester Street, London, E.C.* EXETER, 1880.
Fishburn's Tubular Refrigerators. King & Co., *Hull.* YORK, 1886.

Fishburn's Scarboro' Freezer. King & Co., *Hull.* YORK, 1886.
Victoria Knitting Machine. Pim Bros. Limited, *Dublin.* DUBLIN, 1884.
Heavy Steel Railway Churn, with Malleable Top and Dust-proof Lid. Vipan & Headly, *Leicester.* LEICESTER, 1885.
Danish Cream Separator. Vipan & Headly, *Leicester.* LEICESTER, 1885.
"Noiseless Ware." Vernon's Patent China and Glass Company, *London.* GLASGOW, 1883.
Improved Housemaid's Box with Sifter. Wippell Bros. & Row, *High Street, Exeter.* EXETER, 1880.

(5). School Fittings.

School Desks with Shifting Seats. Colman & Glendenning, *Norwich.* STAFFORD, 1878.
Dual Desk, with Separate Gangway Seat. Thomas Larmouth & Co. *Salford.* STAFFORD, 1878.
"Reliance" Lift-up Desk. Midland Educational Co., *Leicester.* LEICESTER, 1885.
Westminster Single Desk, with Sliding Top and Convex Support to the Seat. North of England School Furnishing Company, *Darlington.* YORK, 1886.
"Simplex" Desk with Adjustable Foot Board. Taylor & Co., *Driffield & London.* LEICESTER, 1885.

(6). Gymnastic Apparatus.

Tricycles, W. Carson & Sons, *Dublin.* DUBLIN, 1884.
Tricycles. Fletcher Bros., *Dublin.* DUBLIN, 1884.
Bicycles and Tricycles, Exhibit of. J. Parr & Co., *Leicester.* LEICESTER, 1885.

(7). Foods.

Soluble Dutch Cocoa. Bensdorp & Co., *London.* DUBLIN, 1884.
Pickles and Sauces. Beveridge & Co., *Glasgow.* GLASGOW, 1883.
Miller's Pride Oatmeal. Binns & Armitage, *Derby.* LEICESTER, 1885.
Chocolate Paste. A. J. M. Bolonachi, *London.* YORK, 1886.
Kepler's Extract of Malt and Combinations of it with Pepsine, Chocolate, and Cod Liver Oil. Burroughs, Wellcome & Co., *London.* DUBLIN, 1884.
Preparations of Digestive Ferments. Burroughs, Wellcome & Co., *London.* YORK, 1886.
Optimus Coffee Extract. E. Clarke & Co., *Battersea.* DUBLIN, 1884. LEICESTER, 1885. YORK, 1886.
Currie Powders. J. Edmunds, *London.* NEWCASTLE, 1882.
Chutneys. Jos. Edmunds, *London.* YORK, 1886.
Cocoa Extract and Preparations of Chocolate. J. S. Fry & Sons, *Union Street, Bristol.* EXETER, 1880.
Indian Tea. Indian Tea Co., *Glasgow.* GLASGOW, 1883.
Mustard. Irvine & Co., *Gateshead.* NEWCASTLE, 1882. GLASGOW, 1883.
Midlothian Oat Flour. A. & R. Scott, *Glasgow.* GLASGOW, 1883.

Improved Oat Cakes. A. & R. Scott, *Glasgow.* YORK, 1886.
Preserved Fruits. C. H. Senn & Co., *London.* YORK, 1886.
Rusks, Shortbread, and Oatcakes. W. H. Torrance, *Edinburgh.* LEICESTER, 1885. YORK, 1886.

(8). Domestic Filters.

"Bijou" Filtre Rapide. P. A. Maignen, *Great Tower Street, London, E.C.* EXETER, 1880.
Improved Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.* NEWCASTLE, 1882.
Soldier's Filter. P. A. Maignen, *London.* LEICESTER, 1885.
Field Hospital Filter. P. A. Maignen, *London.* LEICESTER, 1885.
Silicated Carbon Double Chambered Table Filters. Silicated Carbon Filter Company, *Battersea, London.* EXETER, 1880.
Silicated Carbon Filtering Material. Silicated Carbon Filter Company, *London.* NEWCASTLE, 1882.
Carbonised Iron Stone Mound Filter for Water. J. A. Stephan, *Worcester.* EXETER, 1880.
Artificial Stone Filters, for Cleansing Rain Water for Domestic Use. Thorn & Co., *Stafford.* STAFFORD, 1878.

(9). Mineral Waters.

Potash, Soda and Seltzer Waters and Lemonade. British Mineral Water Company, *Glasgow.* NEWCASTLE, 1882.
Preparations of Lime Juice, Aromatic Ginger Ale, and Quinine Tonic. Carter & Co., *Old Refinery, Bristol.* EXETER, 1880.
Zoedone. (Patentee, David Johnson, F.C.S.) Evans & Co., *Wrexham.* CROYDON, 1879.
Lemonade, Lime Juice, and Ginger Ale. Gulliver & Co., *Aylesbury.* CROYDON, 1879.
Seltzer Water. Jewsbury & Brown, *Manchester.* STAFFORD, 1878.
Ginger Ale and Lemonade. Newry Mineral Water Company (Limited), *Liverpool.* CROYDON, 1879.
Seltzer, Soda, and Potash Waters, and Orange Quinine Tonic. G. H. Skinner, 13, *North Street, Exeter.* EXETER, 1880.

(10). Soaps and other Detergents.

Olive Oil Soap. W. Bowden, *London.* LEICESTER, 1885.
Soaps. S. Boyd, *Dublin.* DUBLIN, 1884.
"Lanolin" Soap. Burroughs, Wellcome & Co., *London.* YORK, 1886.
Carbolic Soaps. F. C. Calvert & Co., *Manchester.* DUBLIN, 1884. LEICESTER, 1885. YORK, 1886.
Hydroleine Soap Powder. F. J. Harrison & Co., *Leicester.* LEICESTER, 1885.
Tooth Soap. F. C. Calvert & Co., *Manchester.* LEICESTER, 1885.
Jeyes' Household Disinfecting Soaps. Jeyes' Sanitary Compounds Co., *London.* LEICESTER, 1885.

(11). Antiseptics and Disinfectants.

Red Cross Yellow Fluid. Antiseptic Apparatus Manufacturing Co., *London.* NEWCASTLE, 1882.
Chemical Substances used in Disinfection. S. Boyd, *Dublin.* DUBLIN, 1884.
50°/$_0$ Carbolic Disinfecting Powder. F. C. Calvert & Co., *Manchester.* GLASGOW, 1883.
Soluble Cresol. F. C. Calvert & Co., *Manchester.* DUBLIN, 1884.
Preparations from Carbolic Acid. F. C. Calvert & Co., *Manchester.* YORK, 1886.
Alum Cake. Dublin and Wicklow Manure Co., *Dublin.* DUBLIN, 1884.
Jeyes' Perfect Purifier. Jeyes' Sanitary Compounds Company, *Cannon Street, London, E.C.* CROYDON, 1879. NEWCASTLE, 1882. GLASGOW, 1883. DUBLIN, 1884. YORK, 1886.
Pixene. J. Wheeler, *Ilfracombe.* GLASGOW, 1883. DUBLIN, 1884.
Sanitary Night Lights. A. Wright, *London.* LEICESTER, 1885.

(12) Disinfecting Apparatus.

Improved Vaporiser for Disinfecting. F. C. Calvert & Co., *Manchester.* EXETER, 1880.
Dr. Scott's Disinfecting Apparatus. Maguire & Son, *Dublin.* NEWCASTLE, 1882. DUBLIN, 1884.
Lyon's Disinfector. Manlove, Alliott, Fryer & Co., *Nottingham.* NEWCASTLE, 1882.

CLASS V.—MISCELLANEOUS.

Articles of Sanitary interest not included in the above Classes, such as :—

(1). Scientific Instruments.

Large Legible Spirit Thermometer. P. Hinckes Bird, 1, *Norfolk Square, London, N.W.* EXETER, 1880.
Instruments used by Medical Officers of Health. Brady & Martin, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Schaible's Apparatus for the Estimation of Carbonate of Lime in Cement. Casebourne & Co., *West Hartlepool.* YORK, 1886.
New Oven Pyrometer. Joseph Davis & Co., *London.* NEWCASTLE, 1882.
Thermometrical Instruments. G. E. Pritchett, 20, *Spring Gardens, London, S.W.* STAFFORD, 1878.
Barometrical and Thermometrical Instruments. G. E. Pritchett, 20, *Spring Gardens, London, S.W.* CROYDON, 1879.
Improvements in Thermometrical and Barometrical Instruments, G. E. Pritchett, 20, *Spring Gardens, S.W.* EXETER, 1880.
Webster's Photometer. Webster & Co., *Nottingham.* CROYDON, 1879.

(2). Books and Periodicals.

Exhibit of Drawings and Books Relating to Disposal of Sewage in Paris. A. Durand Claye, *Paris.* GLASGOW, 1883.

Publications. Ladies' Sanitary Association, *Berners Street, London, W.* STAFFORD, 1878.

Sanitary Publications. Smith, Elder, & Co., *London.* NEWCASTLE, 1882. GLASGOW, 1883. DUBLIN, 1884.

(3). Models and Drawings.

No awards.

(4). Prevention of Accidents.

Leander Life Belt. J. W. Elvery & Co., *Dublin.* DUBLIN, 1884.

Method of Rendering Timber Non-inflammable. A. Gardner & Son, *Glasgow.* GLASGOW, 1883.

Hand Ambulance. Leicester Ambulance Corps, *Leicester.* LEICESTER, 1885.

Safety Belt Shippers. Selig, Sonnenthal & Co. (Limited), *Lambeth Hill, Queen Victoria Street, London, E.C.* CROYDON, 1879.

(5). Respirators and Face Guards for Unhealthy Occupations.

No awards.

(6). Fire Preventing Appliances.

Dicks' L'Extincteur. J. Hildesheim, *Glasgow.* GLASGOW, 1883.

Chemical Fire Exterminator. J. Sinclair, 104, *Leadenhall Street, London, E.C.* CROYDON, 1879.

(7). Methods for the Disposal of the Dead.

"Earth to Earth" Coffins. London Necropolis Company, *Strand, London, W.C.* STAFFORD, 1878.

Folding Bier and Car for Simplifying Funerals. S. Stretton, *Kidderminster.* CROYDON, 1879.

ALPHABETICAL LIST OF MEDALS AWARDED AT THE EXHIBITIONS.

RICHARDSON MEDAL.

Edmundson, J., & Co., *Dublin*, for Swann's Incandescent Electric Lamps. DUBLIN, 1884.

Messrs. Mather & Armstrong, *Newcastle-upon-Tyne*, for Siemens's Regenerative Gas Burner. NEWCASTLE, 1882.

Silicate Paint Company, *Cannon Street, E.C.*, for Griffiths' Patent White. STAFFORD, 1878.

SILVER MEDALS.

Offered by the Gas Department of the Corporation of Leicester.

Fletcher, Thomas, *Thynne Street, Warrington*, for Large Gas Cooking Stove with Boiler. LEICESTER, 1885.

The General Gas Heating and Lighting Co., 66, *St. Paul Street, N.*, for Fibre Asbestos Open Gas Fire. LEICESTER, 1885.

Wright, J., & Co., *Broad Street, Birmingham*, for Eureka Artisan Gas Cooking Stove. LEICESTER, 1885.

SILVER MEDALS.

Offered by the Exeter Gas Company.

Davis, H. & C., & Co., 200, *Camberwell Road, S.E.*, for FibreAsbestos Open Gas Fire. LEICESTER, 1885.

The General Gas Heating and Lighting Co., 66, *St. Paul Street, N.*, for Large Gas Cooking Stove with Boiler. LEICESTER, 1885.

Sanitary and Economic Supply Association, for Dr. Bond's Euthermic Ventilating Gas Stove. EXETER, 1880.

Wright, J. & Co., *Birmingham*, for Eureka Gas Cooking Stove. DUBLIN, 1884.

MEDALS AND SPECIAL CERTIFICATES.

In cases where awards are made at subsequent Exhibitions for the same Exhibits, only the name of the town and date are given. Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from awards of Medals ; but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following list by asterisks placed against the name of the town at which the Exhibition was held.

Aluminium Crown Metal Co., *Glasgow*, for Aluminium Crown Metal, GLASGOW, 1883.

Ashwell, F., *Leicester*, for Blackman Air Propeller. LEICESTER, 1885.

Aveling & Porter, *Rochester*, for Improved Six-Ton Steam Road Roller. CROYDON, 1879.

Aylesbury Dairy Company, *London*, for Exhibit of Dairy Appliances. YORK, 1886.

Bean, A. T., 5, *Cannon Row, S.W.*, for Direct Acting Valveless Waste Preventer. EXETER, 1880.

Billing & Co., *Hatton Garden, E.C.*, for Apparatus for Cooking by Gas. STAFFORD, 1878. *CROYDON, 1879.

Borwell, J., *Britannia Foundry*, *Burton-on-Trent*, for Improved Washer, with table complete. LEAMINGTON, 1877.

Bostel, D. T., *Duke Street*, *Brighton*, for Excelsior Water Closet. LEAMINGTON, 1877. *STAFFORD, 1878.

Boulnois, H. P., *Portsmouth*, for "Acme" Sewer Pipes. GLASGOW, 1883.

Bourtreehill Coal Co., *Dreghorn*, *Ayrshire*, for White Enamelled Fireclay Cistern. LEICESTER, 1885.

Bradford, T. & Co., *High Holborn, W.C.*, for New "Shuttle" Steam Power Washing Machine. LEAMINGTON, 1877. *STAFFORD, 1878.

" " for Washing Machines. NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.

British Sanitary Company, *Glasgow*, for Dry Earth Closet. NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.

Brown, A. & Co., *Glasgow*, for "Stott" Gas Burner. *GLASGOW, 1883.

Buchan, W. P., *Glasgow*, for his exhibit of Sanitary Appliances. GLASGOW, 1883.

Burroughs, Wellcome & Co., *London*, for Powders for Peptonizing Milk. DUBLIN, 1884.

Calvert & Co., *Bradford*, for Calvert's Carbolic Acid for disinfecting purposes. LEAMINGTON, 1877. *CROYDON, 1879. *EXETER, 1880. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885. *YORK, 1886.

Carter, J., 6*a*, *Cavendish Street, W.*, for Invalid Furniture. EXETER, 1880.

Casebourne & Co., *West Hartlepool*, for Faija's Cement Testing Machine. YORK, 1886.

Chorlton & Dugdale, *Manchester*, for Excelsior Spring Mattress. LEAMINGTON, 1877. *STAFFORD, 1878. *CROYDON, 1879. *EXETER, 1880. *NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.

" " for "Swing" Woven Wire Mattress. DUBLIN, 1884.

Cliff, Joseph & Sons, *Leeds*, for Porcelain Bath. GLASGOW, 1883. *YORK, 1886.

Colman & Glendenning, *Norwich*, for School Furniture. EXETER, 1880.

Craig, J. & M., *Kilmarnock, N.B.*, for Enamelled Fireclay Sinks. DUBLIN, 1884.

Davis, H. & C., & Co., 200, *Camberwell Road, S.E.*, for Artisan Gas Cooking Stove. LEICESTER, 1885.
Davis, H. & C., & Co., *London*, for Fibre Asbestos Open Gas Fire. *YORK, 1886.
Davis, H. & C., & Co., *London*, for Enamelled "Metropolitan" Gas Cooking Stove. YORK, 1886.
Dick, Alex., *London*, for Delta Metal. GLASGOW, 1883.
Dœker Hospitals and Huts Factory, *London*, for Dœker Portable Hospital. YORK, 1886.
Donegal Industrial Fund, for Innocuously-dyed Woollen Goods. DUBLIN, 1884.
Doulton & Co., *Lambeth*, *London*, for Stanford's Joints for Stoneware Pipes. STAFFORD, 1878. *EXETER, 1880.
„ „ for Anti-Percussion High Pressure Valves. CROYDON, 1879. *EXETER, 1880. *GLASGOW, 1883. *DUBLIN, 1884.
„ „ for Ventilating Tile Stove. EXETER, 1880. *NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.
„ „ for Anti-Percussion Ball Valve. NEWCASTLE, 1882.
„ „ for Art Pottery. DUBLIN, 1884. *LEICESTER, 1885.
„ „ for Peto Fireproof Flooring. LEICESTER, 1885.
Dublin & Wicklow Manure Co., *Dublin*, for Strype's Process for Drying Blood. DUBLIN, 1884.
Duncan, Maj. F., *The Common*, *Woolwich*, for Ambulance Wheeled Litter. STAFFORD, 1878.
Edmundson, J. & Co., *Dublin*, for their Exhibit of Swann's Incandescent Electric Lights. DUBLIN, 1884.
Elgood, Bros., *Leicester*, for Artistic Domestic Iron Work. LEICESTER, 1885.
Ellis, J., & Sons, *Barrow-on-Soar*, for Barrow Blue Lias Hydraulic Lime. LEICESTER, 1885.
Ellison, J. E., *Leeds*, for Conical Ventilators. STAFFORD, 1878. *CROYDON, 1879. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.
Fletcher, Thomas, *Thynne Street*, *Warrington*, for Large Gas Cooking Stove with Boiler. LEICESTER, 1885.
Fletcher, Thomas, *Thynne Street*, *Warrington*, for Horizontal Spiral Lavatory Heater. *LEICESTER, 1885.
Foulds, E., *Leeds*, for Crabtree's Kitchen Range. *YORK, 1886.
Fraser Bros., *Commercial Road*, *E.*, for Portable Disinfecting Apparatus. CROYDON, 1879
Galbraith, T., *Crawford Square*, *Londonderry*, for Hot-Air Bath. LEAMINGTON, 1877.
Gandy, Maurice, *Liverpool*, for Cotton Machine Belting. EUBLIN, 1884.
General Gas Heating and Lighting Co., 66, *St. Paul Street*, *N.*, for Large Gas Cooking Stove with Boiler. LEICESTER, 1885.
General Gas Heating and Lighting Co., 66, *St. Paul Street*, *N.*, for Fibre Asbestos Open Gas Fire. LEICESTER, 1885.

Greenall, J., *Manchester*, for Steam Washer. LEICESTER, 1885. *YORK, 1886.

Hall, John & Co., *Stourbridge*, for Fire-Clay Enamelled Bath. GLASGOW, 1883.

Hamilton & Co., *Leadenhall Street, E.C.*, for Prismoidal Pavement and Floor Lights. CROYDON, 1879.

Hancock, F. & C., *Dudley, Worcester*, for Machine for Washing and Cooling Butter. LEAMINGTON, 1877. *STAFFORD, 1878.

„ for Machines for Domestic use. GLASGOW, 1883. *LEICESTER, 1885. *YORK, 1886.

Haresceugh, B. B. & Co., *Bentinck Street, Leeds*, for Excreta Pail (oak) with Spring Lid. LEAMINGTON, 1877. *STAFFORD, 1878.

Harris, G. H., *Bristol Street, Birmingham*, for Economical Cooking Range. LEAMINGTON, 1877. *STAFFORD, 1878.

Harris, J. F. & G., *London*, for Moulded Wood Decoration. YORK, 1886.

Hassall & Singleton, *Birmingham*, for Phœnix Portable Range, and the Birmingham Range with Reducible Fire without Gas. STAFFORD, 1878.

Hayward, Tyler & Co., *London*, for Full-flush Valveless Closet. NEWCASTLE, 1882.

Heap, R. R., *Manchester*, for Dry Earth or Ashes Closet. GLASGOW, 1883. DUBLIN, 1884.

Hilliard, W. B., & Sons, *Glasgow*, for Hospital and Sick Room Appliances. GLASGOW, 1883.

Humber & Co., *Nottingham*, for their Exhibit of Bicycles and Tricycles. LEICESTER, 1885.

Hunt, Nathan, *Bristol*, for Auto-Pneumatic Ventilation. EXETER, 1880.

Dr. Jaeger's Sanitary Woollen System Company, *London*, for Sanitary Clothing. YORK, 1886.

Jeyes' Sanitary Compounds Co., *London*, for Jeyes' Perfect Purifier. LEICESTER, 1885.

Johnson, W. F., *Leicester*, for Ornamental Domestic Appliances. LEICESTER, 1885.

Keith, J., *London and Edinburgh*, for Challenge Hot-water Boiler. GLASGOW, 1883.

Kenworthy, E. N., & Co., *Oldham*, for Equipoise Wringing and Mangling Machine. YORK, 1886.

Lascelles, W. H., *Bunhill Row, E.C.*, for Concrete Bath in one piece. CROYDON, 1879. *EXETER, 1880.

Le Grand & Sutcliffe, *Bunhill Row, E.C.*, for Improvements in Well Sinking Apparatus. LEAMINGTON, 1877. *CROYDON, 1879.

Leggott, W. & R., *Bradford*, for Opener for Fanlights and Sky-lights. LEICESTER, 1885. *YORK, 1886.

Leoni, S., & Co., *Strand*, for Apparatus for Cooking by Gas. STAFFORD, 1878.

Lyon, J. W., *London*, for Steam Disinfector. LEICESTER, 1885. *YORK, 1886.

Mackey, Mackey & Co., *London*, for Chemical Substances used for Disinfection. DUBLIN, 1884.

Maguire & Son, *Dublin*, for their Exhibit of Sanitary and Domestic Appliances. DUBLIN, 1884.

Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for Filtre Rapide. CROYDON, 1879. *EXETER, 1880. *GLASGOW, 1883. *DUBLIN, 1884. *LEICESTER, 1885.

Manlove, Alliott, Fryer & Co., *Nottingham*, for Fryer's Destructor, Fryer's Carbonizer, and Firman's Dessicating and Rendering Apparatus. NEWCASTLE, 1882

Mather & Armstrong, *Newcastle-upon-Tyne*, for Siemens's Regenerative Gas Burner. NEWCASTLE, 1882.

Meyer, H. C., *New York*, Sanitary Engineer of New York, Newspaper. GLASGOW, 1883.

Moore, J., *St. James' Walk, Clerkenwell, E.C.*, for Glass Louvre Ventilators. EXETER, 1880.

Morris, Little & Co., *Doncaster*, for Little's Soluble Phenyle. STAFFORD, 1878.

Morrison, W. B., *Glasgow*, for Wedgwood Ornamental Tiles. GLASGOW, 1883.

Moser, L., *Southampton*, for Dry Closet, suitable for Ashes or Disinfecting Powder. EXETER, 1880.

Moule's Patent Earth Closet Company, 5*a*, *Garrick Street, W.C.*, for Earth Closets. STAFFORD, 1878. *CROYDON, 1879. *LEICESTER, 1885. *YORK, 1886.

Musgrave & Co., *Belfast*, for Slow Combustion Stoves. DUBLIN, 1884.

Orr, J. B., & Co., *Charlton, London*, for Leadless "Charlton White" Paint and Dryers. GLASGOW, 1883.

Parker, J., *Woodstock, Oxford*, for Dry Earth Closet. LEAMINGTON, 1877.

Pim Bros., *Dublin*, for their Exhibit of Furniture. DUBLIN, 1884.

Pocock, Bros., *Southwark Bridge Road*, for "Universal" Invalid Tubular Water and Air Bed. STAFFORD, 1878. *CROYDON, 1879.

Pritchett,, G. E., 20, *Spring Gardens, S.W.*, for Economic Hollow Flooring. STAFFORD, 1878. *CROYDON, 1879.

Purdy, W., *Eastwood, Notts.*, for Miners' Safety Lamp. LEICESTER, 1885.

Read, Jefferson, *Birmingham*, for Arcanum Process of Silver Plating Steel. CROYDON, 1879.

Richardson, J., & Co., *Leicester*, for their Exhibit of Antiseptic Preparations. LEICESTER, 1885.

Roberts, C. G., *Haslemere, Surrey*, for Rain-water Separator. NEWCASTLE, 1882. *GLASGOW, 1883.

Ross, J. A. G., *Newcastle-upon-Tyne*, for Silicate Cotton (Slag-wool). NEWCASTLE, 1882.

Rothwell, W., *Bolton*, for Flat Web Knitting Machine, and Rothwell Knitting Machines. DUBLIN, 1884.

Sanitary Appliance Company, *Salford*, for Portable Cinder Sifting Ash Closet, with Soil Pail. STAFFORD, 1878. *CROYDON, 1879. *LEICESTER, 1885. *YORK, 1886.

Sanitary & Economic Supply Association, *Gloucester*, for Dr. Bond's Euthermic Gas Stove. EXETER, 1880.

Sanitary & Highway Appliance Co., *Sheffield*, for Roberts's Street Orderly Bin. LEICESTER, 1885.

Sanitary & Highway Appliance Co., *Sheffield*, for Roberts's Sand-distributor for 2-horse Tram-track. LEICESTER, 1885.

Sanitas Company (Limited), *London*, for Sanitas Oil. NEWCASTLE, 1882.

Scottish Asbestos Co., *Glasgow*, for Scottish Asbestos. GLASGOW, 1883.

Shanks & Co., *Barrhead, N.B.*, for Siphon-action Water Waste Preventer. DUBLIN, 1884.

Shaw, A., & Son, *Glasgow*, for " Sine quâ non " Open and Close Fire Range. GLASGOW, 1883.

Silicate Paint Company, *Cannon Street, E.C.*, for Griffiths' White, and for their preparations of Silicate Paint, Enamel Paint, and Petrifying Liquids. STAFFORD, 1878.

Sinclair, G., *Leith*, for Mechanical Stoker. GLASGOW, 1883.

Sinclair, J., *Leadenhall Street, E.C.*, for Tyndall's Smoke Respirator. CROYDON, 1879.

Singer Manufacturing Company, *London*, for Friction Driving Attachment for Sewing Machines. GLASGOW, 1883.

Smallman, John L., *Dublin*, for Stott's Mercury Gas Governor. *DUBLIN, 1884.

Smith, E., & Co., *Coalville*, for Embossed Tiles. LEICESTER, 1885.

Société Française D'Hygiène, *Paris*, for Chemical Preparations and Apparatus. LEAMINGTON, 1877.

" " *Paris*, for Books on Hygiène. NEWCASTLE, 1882.

Spongy Iron Water Purifying Company, *Oxford Street, W.C.*, for Bischof's Spongy Iron Filter. LEAMINGTON, 1877.

Stewart, J., Sen., *Glasgow*, for Stoneware Disconnecting Traps. GLASGOW, 1883.

" " *Glasgow*, for Stoneware Pipes with Stanford's Joint. *GLASGOW, 1883.

Stott, James, & Co., *Oldham*, for Mercury Gas Governor. NEWCASTLE, 1882. *LEICESTER, 1885.

Trott, H., *Battersea, London*, for the " Household " Closet. *LEICESTER, 1885.

Turk, R. J., *Kingston-on-Thames*, for Cruising Canoe. LEICESTER, 1885.

Tylor & Sons, *Newgate Street, E.C.*, for Flushing Rim Lavatory Basin and Apparatus. EXETER, 1880.

Verity, E. & J. M., *Leeds*, for Crabtree's Kitchen Range. LEICESTER, 1885.

Victoria Stone Co., *London*, for Victoria Artificial Stone-Paving. LEICESTER, 1885.

Vipan & Headly, *London*, for their Exhibit of Dairy Appliances. LEICESTER, 1885.

Walker, Chas. W., *Wandsworth Common*, for Acid Pump and Syphon. CROYDON, 1879.

Walker, Turnbull & Co., *Falkirk*, for Artizan Cooking Range. GLASGOW, 1883.

Ward, E., & Co., *Bradford*, for Exhibit of Sanitary Clothing. YORK, 1886.

Ward, O. D., *London*, for Household Water Closet. NEWCASTLE, 1882.
„ „ for Bean's Direct Acting Valveless Waste Preventer. *NEWCASTLE, 1882.
Waterproof Paper and Canvas Company, *London*, for Willesden Paper Roofing. YORK, 1886.
Webb, H. Chalk, *Worcester*, for Colouring Patterns through the Substance of Wood. EXETER, 1880.
Wenham, W. P., *Church Street*, *Croydon*, for Improved Open or Close Range Kitchener. CROYDON, 1879.
Wenham's Patent Gas Lamp Co., *London*, for Wenham Ventilating Gas Lamp. DUBLIN, 1884.
Wentworth, F., & Co., *London*, for "Kredemnon" Life-saving Garments. GLASGOW, 1883.
Whyte & Bradford, *Bowness*, for Cooking Range with Revolving Fire for the Prevention of Smoke. GLASGOW, 1883.
Wilberforce School for the Blind, *York*, for Wickerwork and Brushes. YORK, 1886.
Wilkinson, W. B. & Co., *Newcastle-upon-Tyne*, for Damp-proof Concrete Pavement. NEWCASTLE, 1882.
Willacy, R., *Preston*, for Sand-distributor for Roads. LEICESTER, 1885.
Willcocks & Co., *Burmantofts*, *Leeds*, for Silica Glazed and Enamelled Fire Clay Bricks and Fäience. CROYDON, 1879.
Wilson Engineering Company, *Holborn*, *W.C.*, for Wilson Portable Close Cooking Range. EXETER, 1880.
„ „ for Improved Wilson Range. with Steel Boiler and non-conducting Jacketing. NEWCASTLE, 1882. *GLASGOW, 1883. *DUBLIN, 1884.
Wippell Bros. & Row, 231, *High Street*, *Exeter*, for Moule's Earth Closet. *EXETER, 1880.
Woollams & Co., *High Street*, *Marylebone*, for Paper Hangings free from Arsenic. CROYDON, 1879. *NEWCASTLE, 1882.
„ „ for Non-Arsenical Pigments and Paper Hangings. *GLASGOW, 1883.
Woodhouse & Rawson, *London*, for their Incandescent Electric Lamp. LEICESTER, 1885. *YORK, 1886.
Woodhouse and Rawson Electric Supply Company of Great Britain, *Bradford*, for Magnetic Cut Out for Electric Lighting. YORK, 1886.
Wright, J., & Co., *Birmingham*, for "Eureka" Gas Cooking Stove. DUBLIN, 1884.
Wright, J., & Co., *Broad Street*, *Birmingham*, for "Eureka" Artisan Gas Cooking Stove. LEICESTER, 1885.
Wright, J., & Co., *Broad Street*, *Birmingham*, For Lump Asbestos Open Gas Fire. LEICESTER, 1885.

ALPHABETICAL LIST OF CERTIFICATES AWARDED AT THE EXHIBITIONS.

Adams, R., 7, *Great Dover Street, S.E.*, for Adjustable Shoe, and Regulating Spring Hinge for Swinging Doors. CROYDON, 1879.

,, ,, for Fanlight Openers and Casement Fasteners. CROYDON, 1879.

,, ,, for the Norton Door Spring DUBLIN, 1884.

,, ,, for Adjustable Pivot for Fanlights. DUBLIN, 1884.

,, ,, for "Victor" Spring Hinge. LEICESTER, 1885.

,, ,, for Side Gussets for Fanlights. LEICESTER, 1885.

Adams & Co., *York*, for Potts' Edinburgh Sewer Trap. LEICESTER, 1885.

,, ,, for Improved Shape of Trough for Water Closets. LEICESTER, 1885.

,, ,, for 30 Gallon Combined Flush-tank and Grease Interceptor. YORK, 1886.

Allen, Thomas, *St. Augustine's Parade, Bristol*, for Metallic Tubular Bedsteads and Invalid Bedrests. STAFFORD, 1878.

Angell, A. T., *London*, for Air-tight Man-hole Door. NEWCASTLE, 1882. GLASGOW, 1883.

Antiseptic Apparatus Manufacturing Co. (Limited), for Red Cross Yellow Fluid. NEWCASTLE, 1882.

Arden Hill & Co., *Birmingham*, for Solid Flame Boiling Stove. NEWCASTLE, 1882.

,, ,, for Gas Cooking Stove, lined with White Tiles. DUBLIN, 1884.

,, ,, for Lump Asbestos Open Gas Fire. LEICESTER, 1885.

Ashwell, Frank, *Leicester*, for Steam Kettle with specially arranged Tap for drawing Boiling Water. LEICESTER, 1885.

Aylesbury Dairy Company, *London*, for Butter Squeezing Machine. YORK, 1886.

Bailey & Co., *London*, for Woodman's Stoneware Screw Plug and Collar, for access to Drains. YORK, 1886.

Baird, W., *Dublin*, for Butler's Sink, lined with Block Tin. DUBLIN, 1884.

,, ,, for White Enamelled Fireclay Sinks. DUBLIN, 1884.

,, ,, for Bath, with Shower Douche and Spray Fittings combined. DUBLIN, 1884.

Baird, W., *Dublin*, for Lavatory, with Shampooing Apparatus. DUBLIN, 1884.
" " for Hydraulic Ram. DUBLIN, 1884.
" " for Improved Horizontal-Pull Fittings for Baths and Lavatories. DUBLIN, 1884.
Baird, Thompson & Co., *Glasgow*, for Watts's Asphyxiator for Testing Drains with Smoke. DUBLIN, 1884.
Ball, Ancell, *Spalding*, for Folding Invalid Bed. CROYDON, 1879.
Barrett, H. J., *Hull*, for Steel Wheel for Sanitary Carts. YORK, 1886.
Bartrum, Harvey & Co., *London*, for Ventilatorium Waterproof Garments. STAFFORD, 1878.
Beard, Dent & Hellyer, 21, *Newcastle Street, W.C.*, for Artisan Closet. CROYDON, 1879.
" " for Ventilating Drain Syphon. CROYDON, 1879.
Bensdorp & Co., *London*, for Soluble Dutch Cocoa. DUBLIN, 1884.
Bethell, T. P., *Liverpool*, for the "Unique" Folding Box. LEICESTER, 1885.
Beveridge & Co., *Glasgow*, for Pickles and Sauces. GLASGOW, 1883.
Billington Bros., *Liverpool*, for Spring Mattresses. GLASGOW, 1883.
" " for Portable Bed, with Liverpool Spring Mattress. DUBLIN, 1884.
Binnie, J., *Gartcosh*, *Glasgow*, for Salt-glazed Fire-clay Sewer Pipes. GLASGOW, 1883.
Binns & Armitage, *Derby*, for Miller's Pride Oatmeal. LEICESTER, 1885.
Bird, Peter Hinckes, 1, *Norfolk Square, N.W.*, for Method of Costless Ventilation. CROYDON, 1879.
" " for Large Legible Spirit Thermometer. EXETER, 1880.
Bolonachi, A. J. M., *London*, for Chocolate Paste. YORK, 1886.
Borough Leather Warehouse Company, *London*, for Crocodile Hide Leather. GLASGOW, 1883.
Bourtreehill Coal Co., *Dreghorn, Ayrshire*, for Stoneware Drain Pipes. DUBLIN, 1884.
" " for White Enamelled Fireclay Sinks. DUBLIN, 1884.
" " for White Enamelled Sinks and Wash Tubs. LEICESTER, 1885.
" " for White Enamelled Fireclay Laundry Trough. DUBLIN, 1884.
" " for White Enamelled Bricks. DUBLIN, 1884.
Bowden, William, *London*, for Automatic Chariot for Children. NEWCASTLE, 1882.
" " for Olive Oil Soap. LEICESTER, 1885.
Boyd, S., *Dublin*, for Soaps. DUBLIN, 1884.
" " for Chemicals used in Disinfection. DUBLIN, 1884.
Bradford, T., & Co., *Salford*, for Black Diamond Boot & Shoe Cleaning Machine. LEICESTER, 1885.

Bradbury & Co., *Oldham*, for Revolving Shuttle for Sewing Machines. GLASGOW, 1883.

Brady & Martin, *Newcastle-upon-Tyne*, for Central Tube Water Mattress. NEWCASTLE, 1882.

„ „ for Instruments used by Medical Officers of Health. NEWCASTLE, 1882.

Braithwaite & Co., *Leeds*, for Syphon for Water Closet Cisterns. CROYDON, 1879.

„ for Siphon Action Water-waste Preventor. YORK, 1886.

Branksea Island Pottery Company, Limited, *Poole*, *Dorset*, for Stoneware Pipes. EXETER, 1880.

Bray & Co., *Blackman Lane*, *Leeds*, for Improved Gas Burners. CROYDON, 1879.

British and Foreign Mineral Water Company, *Glasgow*, for Potash, Soda and Seltzer Waters, and Lemonade. NEWCASTLE, 1882.

British Sanitary Company, *Glasgow*, for Self-Acting Earth Closet. EXETER, 1880.

Broad & Co., *Paddington*, for White Glazed Facing Bricks. LEICESTER, 1885.

„ „ for White Enamelled Straight and Curved Channels for Inspection Chambers to Drains. LEICESTER, 1885.

„ „ for White Enamelled Fire-clay Gullies. LEICESTER, 1885.

Brock, W., & Co., 177, *Fore Street*, *Exeter*, for Bed Rest with Moveable Arms. EXETER, 1880.

„ „ for "Nonsuch" Adjustable Chair. EXETER, 1880.

Buchan, W. P., *Glasgow*, for Improved Drain Pipe, with Access Cover. NEWCASTLE, 1882.

„ „ for Disconnecting Drain Trap. NEWCASTLE, 1882. GLASGOW, 1883.

„ „ for Grease Trap for Kitchen Sinks. GLASGOW, 1883.

Burn & Baillie, *London*, for Galvanized Cast-iron Air-tight Inspection Chamber and Drain Pipes. YORK, 1886.

„ for "Eclipse" Apparatus for Testing Drain and other Pipes. YORK, 1886.

„ for Indiarubber Expanding Plugs for Drain Testing. YORK, 1886.

Burroughs, Wellcome & Co., *London*, for Absorbent Cotton and Antiseptic Sponges. DUBLIN, 1884.

„ „ for Kepler's Extract of Malt and combinations of it with Pepsine, Chocolate, and Cod Liver Oil. DUBLIN, 1884.

„ „ for preparations of Digestive Ferments. YORK, 1886.

„ „ for "Lanolin" Soap. YORK, 1886.

Bussey & Co., *Museum Works, Peckham, S.E.*, for Patent Spring Mattress. CROYDON, 1879.

Cadle, C., *Dublin*, for Silicate Cotton Composition for covering Steam Pipes. DUBLIN, 1884.

Calvert, F. C., & Co., *Bradford*, for Improved Vaporiser for Disinfecting. EXETER, 1880.

„ „ for 50% Carbolic Disinfecting Powder. GLASGOW, 1883.

„ „ for Carbolic Soaps. DUBLIN, 1884. LEICESTER, 1885. YORK, 1886.

„ „ for Soluble Cresol. DUBLIN, 1884.

„ „ for Tooth Soap. LEICESTER, 1885.

„ „ for Preparations from Carbolic Acid. YORK, 1886.

Candy & Co., *Newton Abbot*, for Granite Vitrified Bricks and Paving. EXETER, 1880.

Capper, Son & Co., *London*, for Brian Jones's Joint for connecting Closet with Soil-pipe. NEWCASTLE, 1882.

Carron Company, *Falkirk, N.B.*, for Combined Close Fire and Gas Cooking Range. GLASGOW, 1883.

Carson, W., & Sons, *Dublin*, for their exhibit of Tricycles. DUBLIN, 1884.

„ „ for Willesden Waterproof Paper and Canvas. DUBLIN, 1884.

„ „ for Tortoise Slow Combustion Stoves. DUBLIN, 1884.

Carter & Co., *Old Refinery, Bristol*, for Preparations of Lime Juice, Aromatic Ginger Ale, and Quinine Tonic. EXETER, 1880.

Casebourne & Co., *West Hartlepool*, for Schaible's Apparatus for the Estimation of Carbonate of Lime in Cement. YORK, 1886.

Chorlton & Dugdale, *Manchester*, for "Sun-light Stove." EXETER, 1880.

„ „ for "Invalids'" Adjustable Bed. EXETER, 1880.

„ „ for "Excelsior" Ship's Berth. GLASGOW, 1883.

„ „ for Hospital Bed, fitted with Raising Appliances. DUBLIN, 1884.

„ „ for Pitch Pine Lath Mattress. DUBLIN, 1884.

„ „ for Hospital Bed, with New Spring Mattress. DUBLIN, 1884.

Clarke, E., & Co., *Battersea*, for "Optimus" Coffee Extract. DUBLIN, 1884. LEICESTER, 1885. YORK, 1886.

Clarke, F. W., Portable Gas Apparatus Company (Limited), *Great Queen Street, W.C.*, for Portable Gas Apparatus for Manufacturing Gas from Gasoline. CROYDON, 1879.

Cliff, J., & Sons, *Leeds*, for Hall's Hanging Tiles. YORK, 1886.

„ „ for White Enamelled Sinks. YORK, 1886.

„ „ for White Enamelled Urinal Floor Channel. YORK, 1886.

Cliff, J., & Sons, *Leeds*, for Simplex Reversible Gully. YORK, 1886.
" " for White and Coloured Glazed Bricks. YORK, 1886.
" " for "Imperial" Slop Sink. YORK, 1886.
Colman & Glendenning, *Norwich*, for School Desks with Shifting Seats. STAFFORD, 1878.
" " for Automaton Seat for Drapers. EXETER, 1880.
Coltman, T., *Leicester*, for Conical Knitting Machine. LEICESTER, 1885.
Compostella Fire-Light Company, *Fenchurch Street, E.C.*, for Compostella Fire Lights for Lighting Fires. STAFFORD, 1878.
Constantine, T. J., *Fleet Street, E.C.*, for Devonshire Cooking Range. EXETER, 1880.
Cooper, H. W., & Co., *London*, for Glass Revolving and Sliding Ventilators. GLASGOW, 1883.
Cordingley, T., & Sons, *Bradford*, for Granite Concrete Pavement. DUBLIN, 1884.
" " for Improved Fibrous Plaster Work. YORK, 1886.
Craig, J. & M., *Kilmarnock*, for Buchan's Trap. EXETER, 1880.
" " for Maguire's Cradle Joint for Drain Pipes. NEWCASTLE, 1882.
" " for Buchan's Drain Trap and Drain Pipes, with Access Cover. NEWCASTLE, 1882.
" " for White Enamelled Fire-Clay Sinks. NEWCASTLE, 1882. GLASGOW, 1883.
" " for Stoneware Disconnecting Traps. GLASGOW, 1883.
" " for White Enamelled Bricks. DUBLIN, 1884.
" " for Buchan's Disconnecting Trap. DUBLIN, 1884.
Cregeen, H. S., *Bromley*, for Air Inlet Head for Drain Ventilation. NEWCASTLE, 1882.
Croft Stone Quarry & Brick Co., *Croft*, *Leicestershire*, for the Croft Artificial Stone Paving. LEICESTER, 1885.
Dales, J. T., *London*, for Porpoise Oil Dubbin. LEICESTER, 1885.
Davis, Joseph & Co., *London*, for New Oven Pyrometer. NEWCASTLE, 1882.
Dillon, E. & C., *York*, for Ventilating Corsets. YORK, 1886.
Dinning & Cooke, *Newcastle-upon-Tyne*, for Cast Iron Channels for Stable Drainage. NEWCASTLE, 1882.
" " for George's Calorigen. NEWCASTLE, 1882.
" " for Jennings's Universal Shampooing Apparatus. NEWCASTLE, 1882.
" " for Grates, Mantel-pieces, and Over-mantels. NEWCASTLE, 1882.
Dockrell, Thomas, Sons & Co., *Dublin*, for Cheap Artistic Non-arsenical Washable Wall Paper. DUBLIN, 1884.

Doulton & Co., *Lambeth*, *London*, for Decorative Tiles for Covering Walls and Floors. CROYDON, 1879.
,, ,, for Disconnecting Gully, with back and side Entrances and iron grating. CROYDON, 1879.
,, ,, for Economical Flush-Out Closet. EXETER, 1880.
,, ,, for Anti-Percussion High-pressure Bib Valves. NEWCASTLE, 1882.
,, ,, for Bath Locking Valves, for preventing waste of water. NEWCASTLE, 1882. DUBLIN, 1884.
,, ,, for Latham's Flap Valve. NEWCASTLE, 1882.
,, ,, for Joint for Drain-pipes. NEWCASTLE, 1882.
,, ,, for Reversible Inlet Gully, with Dished Stoneware Cover and Iron Grating. NEWCASTLE, 1882.
,, ,, for "Lambeth" Flush-out Closet. NEWCASTLE, 1882. GLASGOW, 1883.
,, ,, for Tip-up Lavatory Basin. NEWCASTLE, 1882.
,, ,, for "Lambeth" Trough Closet with Automatic Flush Tank. GLASGOW, 1883.
,, ,, for Silicon Tread for Steps. GLASGOW, 1883. DUBLIN, 1884. LEICESTER, 1885.
,, ,, for Glazed Ware Mantelpiece, with Slow Combustion Grate. DUBLIN, 1884.
,, ,, for Vacuum Flushing Cistern for Closet, with Seat-action Arrangement. DUBLIN, 1884.
,, ,, for cheap Glazed Stoneware Sinks. DUBLIN, 1884.
,, ,, for "Lambeth" Combination Water-closet. DUBLIN, 1884.
,, ,, for Enamelled Ware Open Channels for Manholes. DUBLIN, 1884.
,, ,, for Manhole for Drains, with connections complete. DUBLIN, 1884.
,, ,, for London-made Stoneware Pipes. DUBLIN, 1884.
,, ,, for Economical Combination Closet in two pieces. LEICESTER, 1885.

Dublin & Wicklow Manure Co., for Alum Cake. DUBLIN, 1884.

Duffy & Son, *London*, for Immovable "Acme" System of Solid Wood Flooring. YORK, 1886.

Durand Claye, A., *Paris*, for Drawings and Books Relating to Disposal of Sewage in Paris. GLASGOW, 1883.

Edmunds, J., *London*, for Currie Powders. NEWCASTLE, 1882.
,, for Chutneys. YORK, 1886.

Edwards, J. C., *Trefynant*, *Ruabon*, for Dean's External Drain Traps, with moveable receptacle. CROYDON, 1879.

Elliott, Edminson & Olney, *Manchester*, for Cold Metal Double Cone Mechanical Lead Pipe Joints. LEICESTER, 1885.

Ellis, J. J., *Ellistown Collieries*, for Gordon's Disconnecting Trap. LEICESTER, 1885.

Ellison, J. E., *Leeds*, for "Radiator" Ventilator, with Screw Action. GLASGOW, 1883. DUBLIN, 1884.

Elvery, J. W., & Co., *Dublin*, for the Leander Life Belt. DUBLIN, 1884.

,, ,, for Gentlemen's Ventilated Waterproof Overcoats. DUBLIN, 1884.

Evans & Co., *Wrexham*, for Zoedone. (Patentee, David Johnson, F.C.S.) CROYDON, 1879.

Fell, J., & Co., *Wolverhampton*, for Clark's Anti-splash Tip-up Lavatory Basin. NEWCASTLE, 1882.

,, ,, for Smith's Cast Lead Syphon Traps. NEWCASTLE, 1882.

,, ,, for Water-taps. NEWCASTLE, 1882.

Fergusson & Starkey, *Leicester*, for "Shanks's" Porcelain Lavatory Fittings. LEICESTER, 1885.

,, ,, for Shanks's "Eureka" Spray and Plunge Bath. LEICESTER, 1885.

,, ,, for "Unbreakable" Fire-clay Lavatory Basins for Schools, &c. LEICESTER, 1885.

Finch & Co., 181, *High Holborn, W.C.*, for Large Way Waste Plug, with Protective Cover. CROYDON, 1879.

Fleming, W., *Dublin*, for the Combination Bedstead. DUBLIN, 1884.

Fletcher Bros., *Dublin*, for Exhibit of Tricycles. DUBLIN, 1884.

Fletcher, Thomas, *Warrington*, for Washing Machine, Heated by Gas. LEICESTER, 1885.

Forrest, William, *Newcastle-upon-Tyne*, for The Albo-Carbon Light. NEWCASTLE, 1882.

Foster & Pearson, *Nottingham*, for Morris's Cast Iron Gulley, with Moveable Dip Pipe. LEICESTER, 1885.

Fry, J. S., & Sons, *Union Street, Bristol*, for Cocoa Extract and Preparations of Chocolate. EXETER, 1880.

Gandy, M., *Liverpool*, for Cotton Machine Belting. GLASGOW, 1883.

,, ,, for Steil's Fastener for Machine Belting. GLASGOW, 1883.

Gardner, A., & Son, *Glasgow*, for Spring Mattress. GLASGOW, 1883.

,, ,, for Parquet Flooring. GLASGOW, 1883.

,, ,, for Method of Rendering Timber Non-inflammable. GLASGOW, 1883.

Garton & King, *Exeter*, for Vowel E. Bradford's Family Washing Machine. EXETER, 1880.

General Gas Heating and Lighting Co., 66, *St. Paul Street, N.*, for Artisan Gas Cooking Stove. LEICESTER, 1885.

Gent, J. T., & Co., *Leicester*, for their Exhibit of Electric Bells. LEICESTER, 1885.

Gilbert, E. & A. E., *Broughty Ferry, Forfarshire*, for Improved Seat for Water Closets. GLASGOW, 1883.

Gillow & Co., *Oxford Street, W.*, for Lavatory. STAFFORD, 1878.
Goode & Co., *Loughborough*, for "Invicta" Flushing Cistern. LEICESTER, 1885.
,, ,, for Double Valves for Flow and Return in Hot-water Circulation. LEICESTER, 1885.
Graham, W., *Dublin*, for Ventilated Hats. DUBLIN, 1884.
Greenall, J., *Manchester*, for Marsh Greenall Regenerative Gas Heating Stove. YORK, 1886.
Groom & Co., *London*, for Bower's Potato Steamer. DUBLIN, 1884.
,, ,, for Self-indicating Tea or Coffee Infuser. DUBLIN, 1884.
,, ,, for Well and Dry-Platform Sponge Bath. LEICESTER, 1885.
Grosvenor, F., *Glasgow*, for Stoneware Churns. GLASGOW, 1883.
Groves, E. K., *Bristol*, for Self-acting Sick Bed. GLASGOW, 1883.
Gulliver & Co., *Aylesbury*, for Lemonade, Lime Juice, and Ginger Ale. CROYDON, 1879.
Hamilton, W., *Brighton*, for Invalid "Grasshopper" Couch. STAFFORD, 1878. NEWCASTLE, 1882.
Hammond & Hussey, *High Street, Croydon*, for Hornibrook's Catchment Grating for Steep Gradients. CROYDON, 1879.
Hancock, F. & C., *Dudley, Worcester*, for New Propellor Churn. EXETER, 1880.
,, ,, for Dough Kneading Machine. EXETER, 1880.
,, ,, for Machine for Washing and Peeling Potatoes. NEWCASTLE, 1882.
,, ,, for New Cooker and Steamer. YORK, 1886.
Harriman, W., & Co., *Blaydon-upon-Tyne*, for Fowler's Water-closet. NEWCASTLE, 1882.
Harrison, F. J., & Co., *Leicester*, for Hydroleine Soap Powder. LEICESTER, 1885.
Harrison Patent Knitting Machine Co., *Manchester*, for Knitting Machines. DUBLIN, 1884.
Harrisson, T. Harnett, *Liverpool*, for Iron Basket Sewage-strainer. GLASGOW, 1883.
,, ,, for Improved Method of Connecting Lead Pipes with Stoneware Pipes. GLASGOW, 1883.
Hayward, Tyler & Co., *London*, for Shower and Douche Bracket. NEWCASTLE, 1882.
Headley & Sons, *Cambridge*, for Hose Reel. CROYDON, 1879.
Henderson, Osbert, *Glasgow*, for Albo-Carbon Light. GLASGOW, 1883.
,, ,, for Pendulous Food Warmers. GLASGOW, 1883.
Heron, T., *Manchester*, for Duplex Burner. NEWCASTLE, 1882.
Hildesheim, J., *Glasgow*, for Dicks' L'Extincteur. GLASGOW, 1883.
Hill & Hey, *Halifax*, for Double Current Ventilators. GLASGOW, 1883.

Hilliard, W. B., & Sons, *Glasgow*, for Isolating Curtain. GLASGOW, 1883.
,, ,, for Burn and Wound Boxes. GLASGOW, 1883.
Hilton, W. H., *Leamington*, for various Inventions for Promoting Domestic Economy. STAFFORD, 1878.
Hindle Norton & Co., *Oldham*, for Acme Door Check and Spring (double action). YORK, 1886.
Hindley, E. S., *Bornton*, *Dorset*, for Alcazar Vertical Steam Engine. YORK, 1886.
Hotblack, J., & Son, *Norwich*, for an Improved Shape of Boot. DUBLIN, 1884.
Hutchinson, A., & Co., *Great Winchester Street*, *E.C.*, for India Rubber Gas Tubing. EXETER, 1880.
Humpherson, F., *London*, for "Beaufort" Flush-down Closet. LEICESTER, 1885.
,, ,, for Siphon Flushing Cistern. LEICESTER, 1885.
,, ,, for Clip Pipe Joint. LEICESTER, 1885.
Hydes & Wigfull, *Sheffield*, for Tortoise Slow Combustion Stoves. GLASGOW, 1883.
,, ,, for Tortoise Laundry Stove. GLASGOW, 1883.
Hygienic Stove and Grate Company, 15, *Peel Buildings*, *Birmingham*, for "Eagle" Sanitary Trap, for superseding Bell Traps. CROYDON, 1879.
Indian Tea Company, *Glasgow*, for Indian Tea. GLASGOW, 1883.
Irvine & Co., *Gateshead*, for Mustard. NEWCASTLE, 1882. GLASGOW, 1883.
Dr. Jaeger's Sanitary Woollen System Company, *London*, for Camel's Hair Clothing and Bedding. YORK, 1886.
Jennings, G., *Stangate*, *London*, for "Artisans' Dwellings Sink." CROYDON, 1879.
,, ,, for Universal Shampooing Apparatus. CROYDON, 1879.
Jennings, T., *Lambeth*, for Hospital Flooring. LEICESTER, 1885.
Jewsbury & Brown, *Manchester*, for Seltzer Water. STAFFORD, 1878.
Jeyes' Sanitary Compounds Company, *Cannon Street*, *E.C.*, for Jeyes' Perfect Purifier. CROYDON, 1879. NEWCASTLE, 1882. GLASGOW, 1883. DUBLIN, 1884. YORK, 1886.
,, ,, for Jeyes' Household Disinfecting Soaps. LEICESTER, 1885.
Johnson, W. F., *Leicester*, for his Exhibit of Repoussé and other Brass Work. LEICESTER, 1885.
,, ,, for Galvanized Iron Dust-Bin. LEICESTER, 1885.
Kenworthy, E. N., & Co., *Oldham*, for Paragon Washing Machine with Canadian Washer. LEICESTER, 1885. YORK, 1886.
King & Co., *Hull*, for Fishburn's Tubular Refrigerators. YORK, 1886.
,, ,, for Fishburn's Scarboro' Freezer. YORK, 1886.
Kirk, E. G., *Huddersfield*, for Night Soil Receptacle with Spring Lid. LEICESTER, 1885.

Kirsop & Co., *Newcastle-upon-Tyne*, for Paragon Washing Machine, with Canadian Washer. NEWCASTLE, 1882.
Kite, C., & Co., *London*, for Outlet Ventilator. NEWCASTLE, 1882.
" " for Noiseless Chimney Breast Outlet Ventilator.
" " for Wall Inlet Ventilator. GLASGOW, 1883. DUBLIN, 1884.
" " for Telescoped Wall Inlet Ventilator. LEICESTER, 1885.
Knell, U., 77, *Fore Street, E.C.*, for "Imperial" Ventilating Window CROYDON, 1879.
Ladies' Sanitary Association, *Berners Street, W.*, for Publications. STAFFORD, 1878.
Larmouth, Thomas, & Co., *Salford*, for Dual Desk, with Separate Gangway Seat. STAFFORD, 1878.
Leggott, W. & R., *Bradford*, for Opener for Fanlights and Skylights. GLASGOW, 1883. DUBLIN, 1884.
Leicester Ambulance Corps, for Hand Ambulance. LEICESTER, 1885.
Leoni, S., & Co., *Strand, W.C.*, for "Rheometer" Street Lamp Regulator. STAFFORD, 1878.
Lewis, Mrs. A., *Manchester*, for Tin Cooking Utensils. CROYDON, 1879.
London Necropolis Company, *Strand, W.C.*, for "Earth to Earth" Coffins. STAFFORD, 1878.
Longford Wire, Iron and Steel Company, *Warrington*, for Wood's Double Woven Galvanized Steel Wire Spring Mattress. YORK, 1886.
McCallum, J. B., *Stafford*, for Improved Non-Absorbent Tub or Pail Van. EXETER, 1880.
McGeoch, W., & Co., *Glasgow*, for Dow's Close and Open Fire Cooking Range. GLASGOW, 1883.
Maguire & Son, *Dublin*, for Dr. Scott's Disinfecting Apparatus. NEWCASTLE, 1882. DUBLIN, 1884.
" " for White Enamelled Fireclay Sinks. DUBLIN, 1884.
" " for Cast-iron Drain Pipes, coated with Angus Smith's Preparation. DUBLIN, 1884.
" " for Marsden Tiling for Wall Decoration. DUBLIN, 1884.
" " for New Laundry Stove and Copper Boiler. DUBLIN, 1884.
" " for Wilcocks' Automatic Flushing Closet. DUBLIN, 1884.
Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for "Bijou" Filtre Rapide. EXETER, 1880.
" " for Improved Filtre Rapide. NEWCASTLE. 1882.
" " for Anti-Calcaire Powders for Softening Water. GLASGOW, 1883.
" " for the Soldier's Filter. LEICESTER, 1885.
" " for Field Hospital Filter. LEICESTER, 1885.

Maling, C. T., *Newcastle-upon-Tyne*, for Sanitary Earthenware. NEWCASTLE, 1882.

„ „ for Lavatory Basin with Flushing Rim. NEWCASTLE, 1882.

Manlove, Alliott, Fryer & Co., *Nottingham*, for Lyon's Disinfector. NEWCASTLE, 1882.

Mather & Armstrong, *Newcastle-upon-Tyne*, for Hink's Duplex Lamp, with Extinguisher. NEWCASTLE, 1882.

„ „ for Steam Heating Apparatus, combining heating and ventilating. NEWCASTLE, 1882.

Midland Educational Co., *Leicester*, for the "Reliance" Lift-up Desk. LEICESTER, 1885.

Mitchell, James, *Newcastle-upon-Tyne*, for Mitchell's Steam Washer. NEWCASTLE, 1882

Morgan, J., *Dublin*, for Pith Helmet. DUBLIN, 1884.

Morrison, W. B., *Glasgow*, for "National" Water Closet. GLASGOW, 1883.

Murton, H. A., *Newcastle-upon-Tyne*, for Indiarubber Vessels for hospital use. NEWCASTLE, 1882.

Nailsworth Foundry Company, *Bristol*, for Morgan's Stench Exhaust. NEWCASTLE, 1882.

Newry Mineral Water Company (Limited), *Liverpool*, for Ginger Ale and Lemonade. CROYDON, 1879.

Nightingale & Co., *Great Grimsby*, for Method of Wood Block Flooring. LEICESTER, 1885. YORK, 1886.

North of England School Furnishing Company, *Darlington*, for Westminster Single Desk, with Sliding Top and Convex Support to the Seat. YORK, 1886.

Oates & Green, *Horley Green Fire Clay Works*, *Halifax*, for Drain-cleaning Rods, and Stoneware Horse Manger. STAFFORD, 1878.

Onions, J. C. (Limited), *Birmingham*, for Moser's Self-Acting Dry Closet. CROYDON, 1879.

Parker, J., *Woodstock*, for Dry Earth Commode without Separator. EXETER, 1880.

Parr, J., & Co., *Leicester*, for their Exhibit of Bicycles and Tricycles. LEICESTER, 1885.

Patent Porous Carbon Co., *London*, for Porous Carbon for Filtering Water. LEICESTER, 1885.

Patent Victoria Stone Company, *Kingsland Road, E.*, for Artificial Stone Tubes. CROYDON, 1879.

Pearson & Co., *Dublin*, for the Institution Bed with Woven-Wire Mattress. DUBLIN, 1884.

Pennycook Patent Glazing and Engineering Co., *Glasgow*, for the system of Glazing without Putty. GLASGOW, 1883. DUBLIN, 1884.

Phillips, W., & Son, *London*, for Bronte's Air-tight Cast-iron Manhole Cover. YORK, 1886.

Pim Bros., Limited, *Dublin*, for the Victoria Knitting Machine. DUBLIN, 1884.

„ „ for the Hinged Cot. DUBLIN, 1884.

Potter, G. W., *London*, for "Siphozella" Pipe Fastening. YORK, 1886.
Potts & Co., *Handsworth, Birmingham*, for Edinburgh Air-Chambered Sewer Trap. STAFFORD, 1878.
Pringle, R., M.D., *Blackheath*, for Working Model of Cattle Drinking Trough. LEICESTER, 1885.
Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Warming and Ventilating Appliances. STAFFORD, 1878.
,, ,, for Thermometrical Instruments. STAFFORD, 1878.
,, ,, for Barometrical and Thermometrical Instruments. CROYDON, 1879.
,, ,, for Corrugated Iron Hot-Water Warming Appliances. EXETER, 1880.
Pritchett, E. G., for Improvements in Thermometrical and Barometrical Instruments. EXETER, 1880.
Ransome, S. E., & Co., 10, *Essex Street, W.C.*, for "Milwaukee" Glass Lantern or Hurricane Lantern. CROYDON, 1879.
Rimington Bros. & Co., *Newcastle-upon-Tyne*, for Dean's Gully Trap. NEWCASTLE, 1882.
,, ,, for Enamelled Fire Clay Bath. NEWCASTLE, 1882.
Ross, W., *Glasgow*, for Improved Paragon Valve. GLASGOW, 1883.
Ruffard & Co., *Fire-Clay Works, Stourbridge*, for Porcelain Baths, moulded and glazed in one piece. STAFFORD, 1878.
Salmon, Barnes & Co., *Ulverston*, for Revolving Shutters with Balance Weight Motion. EXETER, 1880.
Sanitary & Highway Appliance Co., *Sheffield*, for Roberts's Asphalte Cauldron. LEICESTER, 1885.
Scott, A. & R., *Glasgow*, for Midlothian Oat-flour. GLASGOW, 1883.
,, for Improved Oat Cakes. YORK, 1886.
Scott, F. R., & Co., *Dublin*, for Solid Oak Parquet Flooring. DUBLIN, 1884.
,, for exhibit of Furniture. DUBLIN, 1884.
Selig, Sonnenthal & Co. (Limited), *Lambeth Hill, Queen Victoria Street, E.C.*, for Safety Belt Shippers. CROYDON, 1879.
Senn, C. H., *London*, for Preserved Fruits. YORK, 1886.
Shanks & Co., *Glasgow*, for Cast Iron Bath. GLASGOW, 1883. DUBLIN, 1884.
,, for Porcelain Lavatories, with moveable caps for access to fittings. GLASGOW, 1883. DUBLIN, 1884.
,, for "Eureka" Spray and Plunge Bath. GLASGOW, 1883.
Sharman, T., *Leicester*, for Heating Apparatus for Small Greenhouses. LEICESTER, 1885.
Sharp, C. H., & Co., *High Holborn, E.C.*, for Ornamental Inlet Ventilators. EXETER, 1880.
Sharp, Jones & Co., *Bourne Valley Pottery, Poole, Dorset*, for Rock Concrete Tubes. CROYDON, 1879.
Shone, Isaac, *Wrexham*, for Pneumatic Liquid Ejector. STAFFORD, 1878.

Short, Patrick, *Dublin*, for the Rhinoceros Hide "S" Boot. DUBLIN, 1884.

Silicated Carbon Filter Company, *Battersea*, for Silicated Carbon Double Chambered Table Filters. EXETER, 1880.

" " for Silicated Carbon Filtering Material. NEWCASTLE, 1882.

Sinclair, J., 104, *Leadenhall Street, E.C.*, for Chemical Fire Exterminator. CROYDON, 1879.

Skinner, G. H., 13, *North Street*, *Exeter*, for Seltzer, Soda and Potash Waters, and Orange Quinine Tonic. EXETER, 1880.

Smith, E., & Co., *Coalville*, for Red Building Bricks. LEICESTER, 1885.

" " for Photographic Embossed and Incised Tiles. LEICESTER, 1885.

" " for Vitreous Floor Tiles. YORK, 1886.

Smith, Elder & Co., *London*, for Sanitary Publications. NEWCASTLE, 1882. GLASGOW, 1883. DUBLIN, 1884.

Smith, James, *Liverpool*, for Open Grate for consuming Smoke. NEWCASTLE, 1882.

Smith, J., & Sons, *Wolverhampton*, for Closed Sectional Sanitary Van. LEICESTER, 1885.

Snell, H. Saxon, *Southampton Buildings*, for Thermhydric Ventilating Hot-Water Open Fire Grate. STAFFORD, 1878.

Staynes & Sons, *Leicester*, for Boot and Shoe Uppers. LEICESTER, 1885.

Stephan, J. A., *Worcester*, for Carbonised Iron Stone Mound Filter for Water. EXETER, 1880.

Stephenson & Travis, *Liverpool*, for Stypium Absorbent Antiseptic Surgical Dressings. DUBLIN, 1884.

Stewart, J., Sen., *Glasgow*, for Disconnecting Chamber for House Drains, with open Stoneware Channels. GLASGOW, 1883.

Stidder & Co., 50, *Southwark Bridge Road, S.E.*, for Swivel, Lock Plug, and Overflow for Sink. CROYDON, 1879.

Stiff, James, & Sons, *Lambeth, London*, for Weaver's Ventilating Sewer Air Trap. STAFFORD, 1878. LEICESTER, 1885.

" " " for their Exhibit of Architectural Terra Cotta. LEICESTER, 1885.

Straker & Love, *Newcastle-upon-Tyne*, for Large Fire-clay Drain-pipes. NEWCASTLE, 1882.

Stretton, S., *Kidderminster*, for Folding Bier and Car for Simplifying Funerals. CROYDON, 1879.

Taylor & Co., *Driffield & London*, for "Simplex" Desk with Adjustable Foot Board. LEICESTER, 1885.

Thomasson & Key, *Worcester*, for Cup Grating for Sinks. NEWCASTLE, 1882.

Thorn & Co., *Stafford*, for Artificial Stone Filters, for Cleansing Rain Water for Domestic Use. STAFFORD, 1878.

Thornburn, William, *Borough Bridge*, for Tubular Calorifer for Greenhouses. NEWCASTLE, 1882.

Torrance, W. H., *Edinburgh*, for Rusks, Shortbread, and Oatcakes. LEICESTER, 1885. YORK, 1886.
Townsend & Co., *Newcastle-upon-Tyne*, for China Cups and other Vessels for Invalid use. NEWCASTLE, 1882.
Trott, H., *Battersea*, for Bib Valves for Hot and Cold Water. LEICESTER, 1885. YORK, 1886.
Twyford, T., *Hanley*, for Lavatory Basins. DUBLIN, 1884.
" " for Slop Sinks. DUBLIN, 1884.
" " India-Rubber Connection for Joining Lead and Earthenware Pipes. DUBLIN, 1884.
Tylor, J., & Sons, 2, *Newgate Street, E.C.*, for "Clear Way" Regulator Valve Water Closet, without overflow communicating with Valve Box. EXETER, 1880.
" " for Improved Enamelled Iron Slop Sink, with Regulator Supply Valve. EXETER, 1880.
" " for Improved Full-Way Stop Valve. EXETER, 1880.
" " for "Waste Not" Regulator Valve. EXETER, 1880. NEWCASTLE, 1882.
" " for Hospital Slop Sink, with Waste-not Regulator Valve. NEWCASTLE, 1882.
" " for Bath Locking Valves for preventing waste of water. NEWCASTLE, 1882.
" " for Flushing-rim Lavatory Basin, with Quick Waste. NEWCASTLE, 1882.
" " for Flush-out Urinal Basin. NEWCASTLE, 1882.
" " for Joint for Lead Pipes. NEWCASTLE, 1882.
" " for Water-closets. NEWCASTLE, 1882.
Tyrrell, Brooke, *Dublin*, for exhibit of Furs. DUBLIN, 1884.
Vernon's Patent China and Glass Company, *London*, for Noiseless Ware. GLASGOW, 1883.
Vipan & Headly, *Leicester*, for Heavy Steel Railway Churn, with Malleable Top and Dust-proof Lid. LEICESTER, 1885.
" " for Danish Cream Separator. LEICESTER, 1885.
Walker, Turnbull & Co., *Falkirk*, for Simplex Cooking Range. GLASGOW, 1883.
Waller, Thomas, 47, *Fish Street Hill, E.C.*, for Cooking Stove with Warm-Air Chamber. CROYDON, 1879.
Walton, F., & Co., *London*, for "Lincrusta Walton." GLASGOW, 1883.
Ward, E., & Co., *Bradford*, for Hygeia Corset. YORK, 1886.
" for "Arachne" Flannel. YORK, 1886.
Warner, J., & Sons, *London*, for Lever Nut for Boiler Cock. LEICESTER, 1885.
Watson, Henry & Son, *Newcastle-upon-Tyne*, for "National" Water-closet. NEWCASTLE, 1882.
" " for Waste-preventing Flushing Syphon. NEWCASTLE, 1882.
" " for "Crown" Cottage Water-closet. NEWCASTLE, 1882.

Webb, A., *Dublin*, for the "Natural" Boot for Ladies. DUBLIN, 1884.
Webster & Co., *Nottingham*, for Webster's Photometer. CROYDON, 1879.
Wenham & Co., *Church Street*, *Croydon*, for Boyle's Mica-Valved Outlet Ventilator. CROYDON, 1879.
Wheeler, J., *Ilfracombe*, for "Pixene." GLASGOW, 1883. DUBLIN, 1884.
White, William, *Abergavenny*, for Hygeian Rock Building Composition. NEWCASTLE, 1882.
White, W. P., *London*, for Nicholl's Hospital Pail. YORK, 1886.
Whitwick Colliery Co., *Coalville*, *Leicester*, for their Exhibit of Terra Cotta. LEICESTER, 1885.
" " for Red Building Bricks. LEICESTER, 1885.
Wilby, W., *Dublin*, for Chain Belting for Machinery. DUBLIN, 1884.
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" " for Chappuis' Daylight Reflector. EXETER, 1880.
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" " for Mawbey's Joint for Stoneware Pipes. LEICESTER, 1885. YORK, 1886.

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ADDRESSES AND LECTURES.

Sir T. Spencer Wells, Bart. President's Address.

The Very Reverend the Dean of York. Sermon Preached in the Minster, September 21st.

Prof. F. S. B. F. de Chaumont, m.d., f.r.s. Address to Section I.

Baldwin Latham, m.inst.c.e., f.r.met.soc. Address to Section II.

William Whitaker, b.a., f.g.s. Address to Section III.

Captain Douglas Galton, r.e., c.b., d.c.l., f.r.s. Lecture to the Congress.

E. C. Robins, f.s.a., f.r.i.b.a. The Artistic Side of Sanitary Science. Address to the Working Classes.

G. V. Poore, m.d. The Story of Bremontier and the Reclamation of Sand Wastes of Gascony. Address to the Working Classes.

James Mansergh, m.inst.c.e. The Supply of Water to Towns. Address to the Working Classes.

PAPERS.

Brabazon, Right Hon. Lord. Open Spaces and Physical Education.

Cooper, R. T., m.a., m.d. The Sanitary Condition of the County Water Channels.

Eassie, W., c.e., f.l.s., f.g.s. Economy of Cremation.

Edwards, J. Vickers, m.inst.c.e. The Sanitation of our Dwellings.

Frankland, Percy, ph.d., f.c.s. Filtration of Water for Towns.

Gass, J. B., a.r.i.b.a. American Sanitation.

Harrisson T. Harnett, m.inst.c.e. An account of an investigation into the classes who administer the Public Health Act.

Lambert, Rev. J. M., m.a., ll.d. Sanitary Associations: their Mission and Methods of Action.

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Merrill, J. The Sheffield Corporation Sewage Works.

Oakley, John, M.R.C.S. Prevalence of Defective Eyesight.

Parkes, Louis, M.D. Milk and Disease.

Pringle, Surgeon-Major R., M.D. The Collection and Storage of Rain and Drinking Water.

Roberts, C., F.R.C.S. Medical Climatology.

Robinson, Prof. H., M.INST.C.E. River Pollution.

Robinson, W. Improved Method of Interment.

Rowntree, Mr. Alderman. Public Health in Relation to Municipal Government.

Seaton, E., M.D., F.R.C.P. The Notification of Infectious Diseases.

Sykes, J. F. J., M.B., L.R.C.P., M.R.C.S. Organisation and Administration for the Control of Infectious Diseases.

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LIST OF MEMBERS AND ASSOCIATES ELECTED DURING THE YEAR 1886.

MEMBERS.

* Life Members. † Passed Examination for Local Surveyors.

*Bernard, William Larkins, 39, *Broad Street, Bristol.*

*†Crimp, W. Santo, A.M.INST.C.E., *Local Board Offices, Wimbledon.*

Cruttenden, Henry Edward, *Brittany House, London Road, St. Leonards-on-Sea.*

*†Curwen, John F., 69, *Highgate, Kendal.*

Cutler, Thomas W., F.R.I.B.A., 5, *Queen Square, Bloomsbury, W.C.*

Edwards, J. Vickers, West Riding Surveyor, *Wakefield.*

Ewan, J. Fraser, M.B., CERT.S.SC.CAMB., *care of E. A. Levy & Co.*, 67, *Cornhill, E.C.*

Lingard, Alfred, 49, *Lambeth Palace Road, S.E.*

Macnamara, Charles E., S.SC.CERT., M.R.C.P.I., *Columbia House, Essequibo, British Guiana.*

*†Morley, J. G., 302, *Romford Road, Forest Gate, E.*

*†Nichols, H. Bertram, *Grosvenor Chambers, Corporation Street, Birmingham.*

North, Samuel W., M.R.C.S., F.G.S., 84, *Micklegate, York.*

*Powell, Francis Sharp, M.P., 1, *Cambridge Square, W.*

Pullin, F. B., L.R.C.P., 5, *Cambridge Park, Guernsey.*

Roberts, William Charles, 28, *Disraeli Road, Putney, S.W.*

Wallace, William, 27*a*, *Old Bond Street, W.*

*Wallis, H. Sowerby, F.R.MET.SOC., 25, *Northwood Road, Highgate, N.*

ASSOCIATES.

* Life Associates. ‡ Passed Examination for Inspector of Nuisances.

*‡BASCOMBE, H. C., 18, *Oxford Street, Totterdown, Bristol.*

*‡BATEMAN, James, *Southcott Lodge, Pewsey, Wilts.*

*‡BLACK, Andrew E., 57, *Academy Street, Inverness.*

BLACK, William Galt, Surgeon-Major, F.R.C.S.E., 2, *George Square, Edinburgh.*

BUCKERIDGE, Walter, 5, *Alexander Street, Westbourne Park, W.*

CHEEK, Philip, 4, *Wharves, Goods Station, King's Cross.*

*‡DARLEY, George, 44, *Ridge Road, Meanwood Road, Leeds.*

*‡EVANS, J. Evan, 100, *Bridge Road, Battersea, S.W.*

FITCH, Charles Frederic, *Cheapside, E.C., and Westwood, Clapham, S.W.*

*‡GOODWYN, Arthur Adye, 81, *Burghley Road, N.W.*

*‡GUNN, Alexander, 123, *King Street, Aberdeen.*

*‡LOWICK, W. Morris, *The Firs, Westbury-on-Trym.*

*MACINTOSH, James, 38, *Langham Street, W.*

*‡REAVELL, George, Jun., *Alnwick, Northumberland.*

*‡SALTER, Thomas, 2, *King's Road, St. Leonards-on-Sea.*

*‡WEBB, James A., 33, *Askew Crescent, Shepherds Bush, W.*

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Little's Patent Soluble Phenyle

(NON-POISONOUS).

SEVENTEEN AWARDS.

Stafford, 1878. **Christchurch, 1882.** **Calcutta, 1884.**

Special Merit.

Gold Medal.

Silver Medal.

Pronounced by the Committee of the American Health Association, sitting in Session at the Johns Hopkins University, Baltimore, 1885, to be

THE BEST DISINFECTANT.

On examination it was found to be

THREE TIMES STRONGER THAN ANY OTHER DISINFECTANT.

Superior to Carbolic Acid; containing the same good properties without its disadvantages.

Destroys the infection of all fevers, and all contagious and infectious diseases.

It is not like many so-called disinfectants, a mere disguiser of bad smells, and not only removes the foul odours, but destroys the disease germs, thus removing all fear of infection.

It is a splendid healer of all kinds of Skin Diseases.

In 6d., 1s., and 2s. 6d. Bottles; and in Quart Tins, 2s. 6d.; Half-Gallon Tins, 4s.; and One Gallon Drums, 7s. 6d.

LITTLE'S SANITARY PHENYLE POWDER

This is a disinfectant of the highest order, and is a preparation of the Soluble Phenyle in Powder form.

It acts immediately on all foul odours, completely subduing them, and destroying infection.

It gives off a refreshing and invigorating odour, and will be found very valuable in the sick room.

It is highly suitable for general domestic purposes, and will drive away Ants, Bugs. and all other noxious insects.

Sold in 6d. and 1s. Tins; also in Cwt. Casks or Bags.

LITTLE'S PHENYLE HOUSEHOLD SOAP.
LITTLE'S PHENYLE TOILET SOAP.
LITTLE'S PHENYLE DOG SOAP.

These Soaps are of Superior Quality, and give every satisfaction.

SOLD BY ALL CHEMISTS.

MANUFACTURERS:

MORRIS, LITTLE & SON, Doncaster

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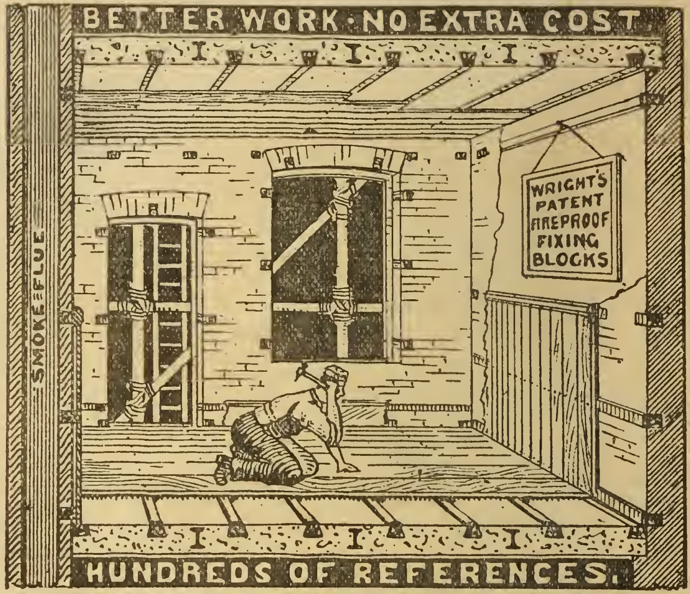
Extensively employed for several years past (in works of the highest class) by eminent Architects, Engineers, H.M. War Department, &c., &c., &c., and now universally acknowledged by practical men to be the best and safest Fixings ever introduced. Never . urn, split, rot, or decay.



N.B.—Architects and Contractors are very respectfully cautioned against infringements of our Patent and Registration Rights.

PATENTED JUNE, 1881.

J. WRIGHT & CO.,

3, WESTMINSTER CHAMBERS, VICTORIA STREET, LONDON, S.W.

For the awards given by the Institute, see Appendix, pages 376A, 438.

THOMAS WRAGG & SONS,

Manufacturers of

Glazed Stoneware Drain Pipes and all descriptions of Sanitary Ware.

Also of Stanford's and Mawbey's Patent Pipes.

Gordon's Patent Disconnecting Syphons,

And Hassall's Patent Safety Joint for Water-tight Sewers.

Terra-Cotta Chimney Tops, Vases, Garden Edgings, etc.

Fire Bricks. Lumps. Tiles.

Crucible and Cement Clays, &c. Glazed Bricks. Blue Bricks.

Ridge and Roofing Tiles, etc.

WORKS—SWADLINCOTE, near BURTON-ON-TRENT.
LOXLEY, near SHEFFIELD.

LONDON OFFICES—10, BEAUFORT BUILDINGS, STRAND

DEPOTS—HAMMERSMITH & CHISWICK, North London Railway.
STOKE NEWINGTON, Great Eastern Railway.
MIDLAND ROAD, SHEFFIELD.

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